Empowering Consumers in the Circular Economy with blockchain-enabled storytelling

TU Delft

CIRCULARISE

Empowering Consumers in the Circular Economy with blockchain-enabled storytelling

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Master thesis

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Abstract

This thesis introduces the vision and implementation to involve and empower end-consumers in the circular economy. This thesis is the graduation project of Strategic product design master's program, developed for Circularise, a B2B company who connects supply chain. It aims for an in-depth understanding of the users need and challenges in the purchase decision of durable products with recycled plastic components.

The project began with literature researches of consumer behaviours with circular products. It also looked into their behaviour with blockchain technology, and current support that blockchain technology provides to a circular economy, namely, supply chain transparency and others. The new target segmentation was created according to literature, and user research was done with the target group. Contextmapping method was used to collect the user's insight, and qualitative data were analysed. The results showed that consumers lack trust in sustainable claims that were advertised by brands, consumers lack motivation since the sustainable impacts are not clearly measurable, and more. The research also showed that blockchain technology in supply chain transparency could provide consumers with trustworthy sustainable data to support their purchase decision of the product.

Based on these insights, new target segment (end-consumers), brand identity, platform design, and a roadmap of implementation plan were created with value exchange between consumers, brands, original equipment manufacturers, part manufacturers, material manufacturers, and recyclers in the future.

This thesis aims to empower consumers by translation blockchain's sustainable claims from manufacturers, into product storytelling. With accumulated value, it also proposes a long-term strategy to connect the consumers to the supply chain. This will further influence the connection of the chain to recyclers and close the loop for the circular economy in the future.

Introduction

The Circular Economy is underpinned by many theories emphasising on keeping resources in circulation to reduce waste and consumption of raw materials [1][2]. An essential strategy for sustainability is the confirmation and verification that processes, products, and activities within the supply chain meet specific sustainability criteria and certifications [3]. In addition to the supply chain, the collaboration of consumers is also crucial, especially in the product life cycle and end of product life [4].

For consumers, generally, there are several behavioural barriers to adopt circular products, especially at the stage of purchase [5]. One of the barriers is having an adverse attitude and perception towards a circular product and service [6]. For example, remanufactured products are often wrongly perceived by the consumer as being of lower quality [7]. This dimension is relevant only if the firms make visible to customers their compliance with the principle of Circular Economy that becomes part of their positioning against competitors. However, there is a question of how much the firm should make visible [8].

Blockchain technology is a potentially disruptive technology incorporating characteristics of a decentralised 'trustless' database [9]. It allows for global-scale transactions and process disintermediation and decentralisation amongst various parties [9]. Lack of transparency in the supply value of any item prevents supply chain entities and customers from verifying and validating the actual value of that item [10]

This project aims to empower consumers to take steps towards a circular economy with a decentralised network that brings transparency to global supply chains. Engaging with consumers will benefit the goal of increasing recycled material adoption and forcing products to become truly sustainable.

A start-up company, Circularise, allows safe, decentralised information exchanges around data in the supply chain such as the recycled content of materials [11]. By using blockchain and zero-knowledge proofs, stakeholders can communicate without compromising on privacy, which affects their competitive advantage. Circularise's technology allows to cut on costs of tracing the material directly, therefore, lowers the cost of recycled materials and increases adoption. Increasing the adoption of recycled materials has a positive effect on the environment and resource efficiency and thus constitutes an essential step towards building a circular economy. To do so, the start-up is in the process of developing a platform for clients. Currently, the complex technical data creates the gap in communicating sustainability value to end-users. By expanding Circularise's customer segment to end-users, this project will bridge between Circularise and end-users to match their level of need in circular economy data.

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[10] Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. International Journal of Production Research, 57(7), 2117-2135.

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1

Project Overview

This chapter introduces the project background, key topics, and their relation. Firstly, the background information of the company, Circularise, and the relationship of blockchain and circular economy. The process overview also introduces methods for this project.

1.1 Company, Circularise

Circularise is developing an open-source protocol and decentralised network to track materials in the supply chain, which enables brands, OEMs, suppliers, and manufacturers to choose recycled materials by presenting circular information about products and supply chains.

Circularise is a start-up company based in the Hague, Netherlands. Circularise is developing an open-source protocol and decentralised network to track materials in the supply chain [11]. The company's mission is to bring transparency to global supply chains and motivate businesses towards a circular economy. Their clients include corporates, governments, start-ups and research institutes.

Current Business Model

A Business Model Canvas was created [12] to conclude Circularise's current business model from research and interviewed with Mesbah Sabur, the Circularise's founder. The discussions of some essential blocks are as follows [13].

Current key partners and customer segments

Circularise is collaborating with polyamide supplier Domo and polymer manufacturer Covestro to test Circularise's approach in pilot cases [14]. They aim to decrease the use of virgin plastics and increase the use of these companies' verified recycled plastics. According to Circularise, the current customer segments of Circularise are brand owners and OEMs (such as plastic consumer product brands in the automotive and travelling suitcase industry). These current key partners and customers are concluded in the customer journey as follows.

Step 1. Material (recycled plastic) manufacturers use Circularise Web application. Material manufacturers join and pay first entry and set up fees. After logging in, they can connect the SAP ERP, or manually enter the material information, and upload recycled plastic certificates. Every 1 kg of the material batch is equal to 1kg of material in the blockchain system (Token). They can select external auditors to verify the material and complete the digitised certificate.

Step 2. The plastic manufacturer also send digitised material batch in Circularise's web application together with the real material to part manufacturer and OEMs

Step 3. OEMs also need to register with Circularise to access the platform. They will receive the material with checkboxes that are pre-checked by auditors. OEMs use these verification data internally to check that they are meeting their sustainable goals.

According to this journey, Circularise is looking forward to involving end consumers (the people that purchase plastic products from these brands or OEMs), and also the plastic recyclers who are responsible for turning the waste into material again.

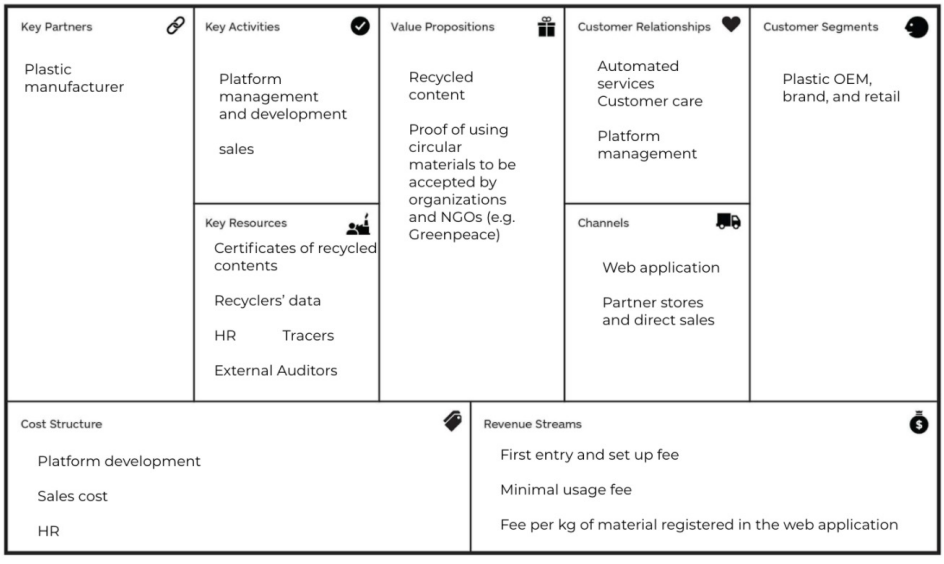

Figure 1.1 The current Business model canvas of Circularise

[12] Osterwalder, A. & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

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[14] Ledger Insights - Covestro, DOMO in blockchain plastic traceability pilot with Dutch startup. Available online: https://www.ledgerinsights.com/blockchain-plastic-traceability-covestro-domo-circularise/ (accessedMay12,2020)

1.1 Company, Circularise

Circularise is developing an open-source protocol and decentralised network to track materials in the supply chain, which enables brands, OEMs, suppliers, and manufacturers to choose recycled materials by presenting circular information about products and supply chains.

Current value proposition

The current value proposition answers to the problem that businesses encounter to take steps toward transparency of the supply chain [11]. Firstly, pieces of information are scattered among stakeholders, and no one has all the information. For example, one knows the recipe of material, and another knows the parts of an assembly. Secondly, the supply chain is a secret. The exact shape and network of supply chains are often not transparent and even kept secret, for it is complicated and secrecy benefits mediators. Moreover, required data is unknown. It is often not known what information is required precisely, as the final destination of materials are subject to a dynamic environment, and future innovations/criteria in reverse logistics are unknown. Lastly, centralisation is unwanted Stakeholders are not keen on openly sharing information or trusting a central party, as it may pose a risk to their competitive advantage.

Circularise provides the solution by having a distributed way to communicate trusted answers to critical questions without having to share user data, identity and position.

Smart questioning is the key to confidentiality while enabling transparency. The recycling partner can access and ask specific questions about the material. The manufacturer or OEMs can choose to answer in estimated numbers or give precise numbers about only some component formula which is enough for a recycler to separate the material. They also have a choice to not provide an answer.

Other than smart questioning, Circularise's value proposition also revolves around the other two offerings, namely, the digitised certificate of recycled content and the product passport.

These the digitised certificate of recycled content, the product passport, and smart questioning are also current key resources that could create opportunities to apply for end consumers.

Figure 1.4 Circularise's current value proposition concluded from an interview with Circularise.

Private Data

	Digitized Certificates of recycled content	**Product Passport**	**Smart Questioning**
Plastic Manufacturer	**Prove recycled content** to their clients and NGOs such as Greenpeace	Communicate products with brand owners	Communicate with recycler without exposing confidential material
Brand owner and OEM	• Reduce auditing costs to prove recycled content • Make verificable claims	Communicate their product with end users	Ask to plastic manufacturer

1.2 Purpose

Circularise's primary goal is to use the recycled plastic information (enabled by blockchain technology) from brands and businesses to assist consumers in making a purchase decision of recycled product (which also creates value for the business clients). This produces values on different levels.

Value for a circular economy

The Circular Economy is a system about keeping resources in circulation to decrease consumption of raw materials and waste in industrial processes and consumption [1]. Verification that processes within the supply chain meet specific sustainability criteria and certifications is a vital strategy [3]. However, in reality, less than one-third of the material is currently recovered [15].

Therefore, to support the recovery of material contents, a collaboration of consumers is also crucial, especially in the product life cycle and end of product life [4].

Many business strategies already rely on end-consumers as the key, namely, product take-back systems. With end-consumers onboard, this creates new opportunities for many collaborative strategies for the circular economy in the future.

Value for end-consumers

Transparency enables customers to verify and validate the item's real value [10], which empower the consumers' roles in the circular economy. This project contributes to an understanding

of consumers' behaviour with sustainable products, especially at the purchasing decision phase, where there are several circular products adoption barriers [5]. While some businesses are already using Blockchain technology to achieve traceability of many products' supply chains, especially for sustainability purposes, blockchain is rarely implemented for end-consumers to use. Studying the role of the consumer in the circular economy and what blockchain could enable will allow us to extract the need and value that blockchain could support.

Value for all stakeholders and Circularise

Circularise enables all manufacturing stakeholders to increase their use of verified recycled resins and decrease their use of virgin plastics. After involving the end-consumers, the future goal could be to include the next stakeholder of the circular economy, which are collectors and recyclers of products.

"Right now, a lot of the materials that the recyclers get do not get properly recycled because they don't know what's in there. So, therefore, this is information that is important for us." Mesbah Sabur, Circularise founder

Since better data is key to finding more appropriate applications for materials of all types, recyclers may use Circularise's platform to check the material's composition. This opens up the opportunity to collaborate between all stakeholders; material manufacturers, part manufacturers, brands, consumers, and recyclers. The platform allows everyone to be connected and make data transactions while protecting confidential data and together, contributes to a more efficient circular economy.

Brands can communicate the brand image better with their consumers, gain brand loyalty, which also benefits the manufacturers who produce for the brands.

"The brand wants to prove that they are actually sustainable. The main thing would be proof that the material is actually recycled" Mesbah Sabur, Circularise founder, talking about the current client, an international suitcase company.

This project has a specific focus on some of Circularise's current business clients, namely, an international suitcase company. Therefore, the product category framing is a durable plastic product category. The product category will be further discussed in Chapter 2.

[15] Ellen MacArthur Foundation - Towards the Circular economy. Available online: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf (accessed Feb 4, 2020).

1.3 Problem statement

The goal of this project is to formulate the value proposition for a new target segment, end-consumers, along with a strategy for an initial brand establishment and platform design. A business model and implementation strategy will also be introduced for long-term business growth. This leads to the following research question.

How can blockchain and supply chain transparency communicate and empower circularity value to consumers?

Who: Circularise

What: Transparency and traceability of material and production

Where: Throughout the supply chain

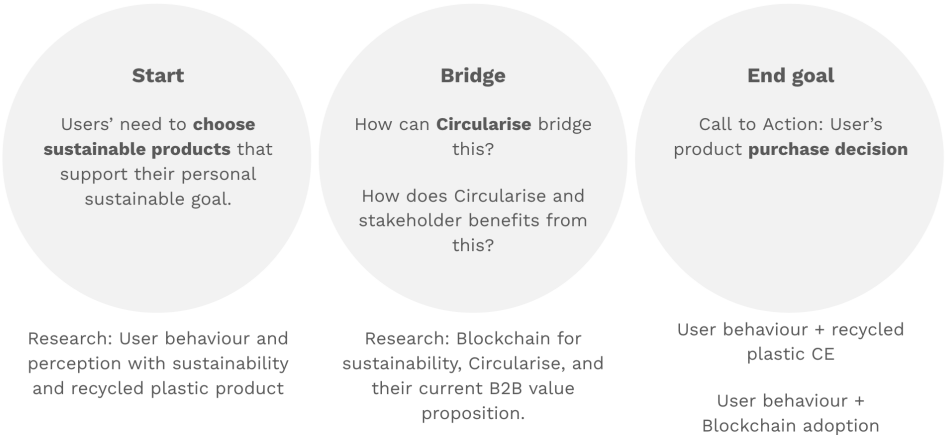
When: During the purchase decision.

Why: To verify brands and their products as sustainable

Why now: For the consumers to be part of the circular economy movement and expand sustainability potential together with other stakeholders in the supply chain.

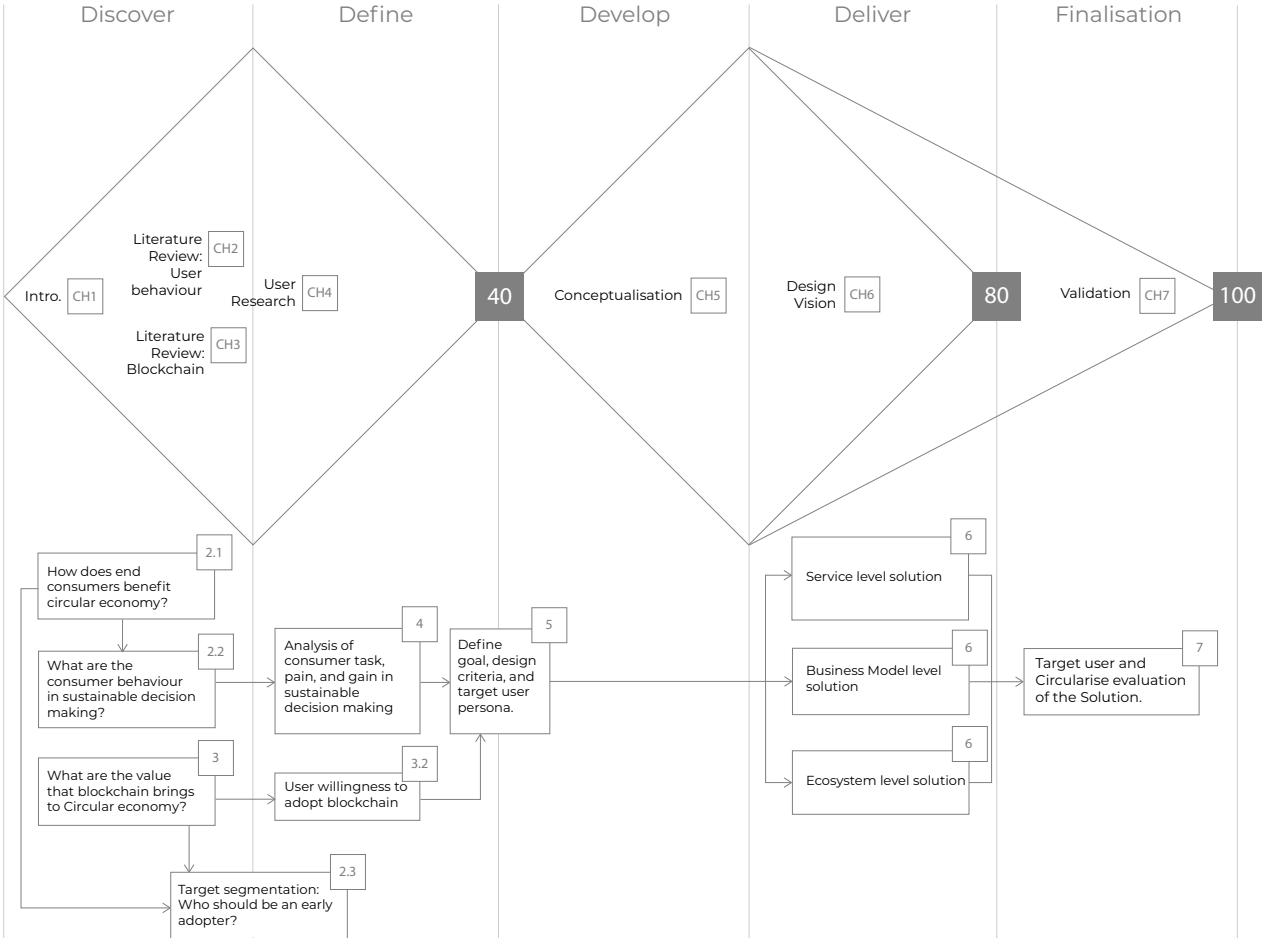
This will provide value to Circularise with the deliverables as follows:

- Define a potential market segment for end-consumers.
- Formulate value proposition, business model, and implementation strategy as a guideline for future development, which also suggests adaptation to other product categories.
- Provide platform execution direction to deliver the value.



1.4 Approach

This project's process develops from a double diamond process. The first diamond is with several methods of research and analysis to discover and define the project. The second diamond is the design sprints before finalising the solution.



Discover

For the first diamond, the main focus was to deepen the understanding of the company, the relation between blockchain and circular economy, and user behaviour towards a circular economy. The process was done by literature review, company interview, user interview, creative sessions with the users, and case studies.

Define

The analysis phase devoted to concluding the findings and creating opportunity areas by analysing the insights and current users' tools and case studies. The outcome of this phase is opportunity areas which will be further developed in details.

Develop and Deliver

The second-diamond covered both developing and delivering solutions by doing design sprints. This phase consisted of several sprints of ideating and designing MVP (minimal viable products) to test with end consumers. This process validated the concepts by developing from the feedback from the tests. The final developed concept was finalised into the final design with the business model, implementation strategy, and recommendation to adapt with other product categories.

→ Next Chapter

More details about blockchain technology and sustainability, and how Circularise creates value proposition in detail.

2

Consumers

Consumers are very relevant stakeholders for businesses as they play an essential role in the product and service purchase [16]. The term sustainable lifestyle refers to consumers' behaviours and choices if these are intentionally aimed at fulfilling sustainable development goals [17][18]. Consumers who adopt a sustainable lifestyle, for instance, minimize the use of energy and water, recycle waste and materials and purchase sustainably produced products [17].

This chapter devotes to an understanding of consumer behaviour with sustainability in general, perception of durable recycled plastic products, and trust in sustainability claims. The literature was reviewed in four themes, drivers of sustainable behaviour, perception of the user with recycled plastic material, consumer behaviour in sustainable decision making, and sustainable user segmentation.

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2.1 Consumer perception of recycled plastic

Firstly, this research dives into the consumer's perception and influences that leads to WIP and other factors that influence user perception of durable products made of recycled plastic, which are Circularise's current material focus.

For products with recycled components, the WTP and consumer responses vary depending on the product category [19] [20]. These responses and WTP are related to the frequency of purchase [20], the level of expected performance [21][22][23][24], the expected life duration [25], the level of the symbolic value of a product [26], and perception of contamination [27]. The insights will be discussed below to scope the category for this project, and the insights that belong to other product categories will serve as strategies to apply to other product categories in the future horizons.

Product category scope for this project:

Durable products made of recycled plastic

An international suitcase company was chosen by Circularise as the focus on this project. We concluded the insights and assumptions, and scoped the category for this project as follows.

Figure 2.1 Images of products in the scope.

Frequency of Purchase

Consumers are more concerned about the sustainability of products they purchase more often (e.g. FMCG) than of products they purchase sparingly (e.g. durables) because of the total amount of waste generated [20].

→ Assumption 1: The amount of recycled plastic components (reduction of waste generated) would positively influence consumer's WIP.

The level of expected performance

Recycled plastic can have negative implications for aesthetics [21], functional performance [22], effort [28], and affordability [23][24].

The expected life duration

This influences how the product's sustainability is perceived since products are preferred to serve the function for as long as possible, therefore has less waste generated. Moreover, consumers often perceived more about energy consumption than material when it comes to the sustainability of durable products [25].

Since this product category does not require energy consumption during usage, we can emphasize the impact of recycling plastic (less waste created).

→ Assumption 2: Impact of recycled plastic components positively influences consumer's WIP.

Since the product lives longer, people could be more concerned about repairment, reuse, and recyclability during disposal.

→ Assumption 3: Raising awareness and assistance in the sustainability factor during product life could be a strategy for WIP of durable recycled-plastic products.

The symbolic value

This affects product communication and consumer's evaluation of recycled plastic products. The fact that the products are consumed publicly make specific product categories (e.g. clothing and fashionable goods) more likely to express an individual's image or personality. Consumers prefer to use more sustainable products when they are consumed in public and therefore contribute to the personal image they wish to have [26].

Perceptions of contamination

This perception can create a negative impact on consumers' perception of circular/recycled products [27]. Consumer perceptions of contamination are mostly related to, or directly contact with, food and drinks (e.g. a coffee machine or a water bottle) or absorbed into consumers' skin (e.g. skincare packaging).

[19] Magnier, L., Mugge, R., & Schoormans, J. (2019). Turning ocean garbage into products–Consumers' evaluations of products made of recycled ocean plastic. Journal of cleaner production, 215, 84-98.

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2.2 Consumer behaviour in sustainable decision-making

Sustainable behaviour indicates behaviour that serves sustainable development goals, or adopted by others who do not subscribe to sustainable lifestyle, but behave sustainably for instance for financial or practical reasons [18]. The decision-making process below illustrates several factors that influence consumer's WIP from the first phase of recognition, consideration, and purchase decision.

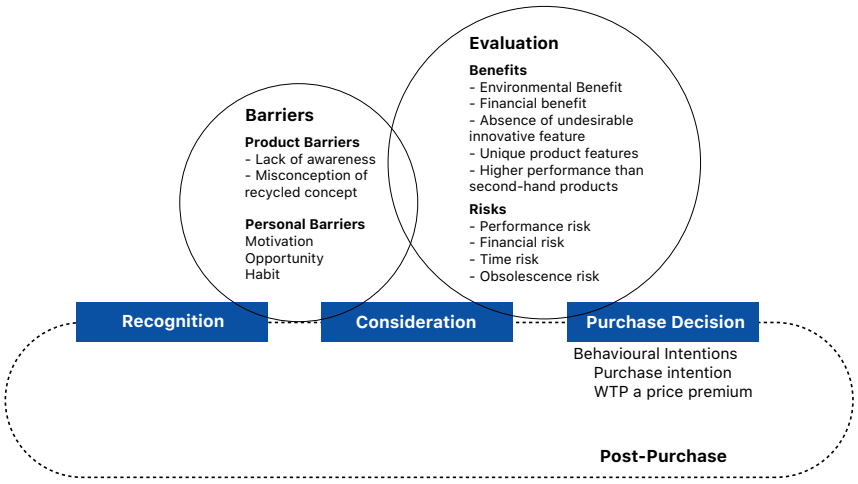

Figure 2.2 Consumer decision-making process that leads to purchase decision (based on [29][30]).

The decision-making starts with recognising the product. The consumers decide which product options have the potential to satisfy their needs [29]. They have an initial consideration set consisting of the alternatives they recall from memory, which are associated with their initial favourable attitude [29]. Consumers search for options and discover new alternatives, then use the preselected alternatives to form a consideration set. There are several product and personal barriers before they arrive to detailed consideration process [29]. At the evaluation phase, users consider the risks and benefits of each alternative [29]. Lastly, consumers tend to select an option with balance risks and benefits and made the purchase decision [29].

To understand the influences during these processes, the literature review focuses on the barriers and the evaluation phase to understand the process between the consumers' consideration of products after recognising it and how they arrive at the purchase decision which is the goal of this project.

Product Barriers

The lack of awareness and misconception of recycled concepts are the barriers for sustainable behaviour [31]. For durable plastic products with recycled components, the lack of awareness and misconception of recycled concepts are the barriers for sustainable behaviour [31]. For mainstream consumers, sustainability behaviour was mostly related to recycling the waste after use, while other sustainable options are unaware of [32]. It is also difficult for consumers to evaluate the impact of their sustainable actions [29], and there are no easy metrics to compare these sustainable behavioural effectiveness [33].

Personal Barriers

The personal barriers were concluded from the barriers that hinder the drivers of sustainable behaviour. Three factors explaining behaviour are motivation, opportunity, and habit [34], these factors are major antecedents of environmental behaviours [35].

Motivation

Motivation (or intention) is determined by attitudes, social norms and perceived behavioural control [36].

Attitude: Sustainable behaviours often face a conflict between immediate self-interest and longer-term collective interests, which is the challenge to overcome a social dilemma, [36][37], especially when alternatives are more expensive, require effort or come with less comfort [36].

Social Norms: Sustainable behaviour is also influenced by social norms, which is what others surrounding us think we should do, or they should do. There are two distinct

[29] Van Weelden, E., Mugge, R., & Bakker, C. (2016). Paving the way towards circular consumption: exploring consumer acceptance of refurbished mobile phones in the Dutch market. Journal of Cleaner Production, 113, 743-754.

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types of norms, injunctive and descriptive norms [38]. Injunctive norms concern what most other people approve or disapprove; descriptive norms are what most others do.

Perceived behavioural control: Sustainable behaviours are influenced by self-efficacy, which is the level of ease or difficulty to perform a particular behaviour, and controllability, which is the extent to which the performance is up to the person who acts it [39]. Feeling in control may motivate and drive sustainable behaviour, but perceived lack of control may prevent a person from sustainable behaviour [40].

Opportunity

A structural Barrier refers to the presence or absence of infrastructure of sustainable products [41], the financial constraints such as when purchasing environmentally friendly devices [42]. General psychological barriers [43] are limited cognition which refers to undervaluing distant or future risks, sunk costs which are associated with previous unsustainable investments, and rebound effects, for example, using more after owning an electrical appliance that saves energy.

Habit

Habits are automatic responses to regularly occurring situations through associative learning [44]. If an action has been repeated sufficiently, it will be done automatically when situation occurs [31]. Some consumers were aware of sustainability but failed to remind themselves when the action was needed [45]. Habits involve influences from outside a person which could be a specific time, situation, or a location; therefore, it is challenging to change habits. At an individual level, a habit may be routines [46]. At a societal level, habits may be part of groups of behaviours, social practice, and others which have meanings and could change over time [47].

Evaluation

Consumers' behaviour and intention towards sustainable products made with recycled plastic are influenced by perceived benefits and perceived risks [19].

Perceived Benefits

Environmental benefits: Circularity in products [48][49] and a recycled appearance [50][51] have a positive effect on individuals' perceived environmental benefits. 92.6% of respondents felt that among the possibilities to make packaging more environment-friendly, recycled packaging was the most beneficial aspect [52].

Anticipated conscience (as an affective benefit related to the adoption of products made of recycled plastic.): Affective product evaluations are determinants of adoption of sustainable product alternatives [53][54]. In the specific case of evaluation of products made of recycled plastics, affective and emotional benefits also seem to play an important role. For example, bottles made of recycled plastic seem to lead to more positive prosocial benefits when a form of proximity to the consumer is embedded in the design of the bottle [55]. Anticipated conscience can be defined as consumer's expectations regarding how the product will make him/her feel in an ethical sense.

Degree of recognisability: The degree that 'made of recycled plastic' fact is reflected in the visual appearance of a product. Consuming sustainable products can serve as a positive social appearance, and owning products made of recycled plastic can be positive for individual's image [26]. These conclude that recognisability may have a positive effect on behavioural responses towards recycled plastic products.

Perceived Risks

The perception of risks in the evaluation phase hinders product adoption [30]. When there is a higher perceived risk or lower perceived quality, consumers are not willing to pay as much for products with recycled contents [20], and these risks should be addressed by manufacturers [56]. The negative consumers' willingness to pay for recycled contents in products is evident and demonstrated in several studies [20] [56] The perceived risks related to quality and functionality [22], limited attractiveness [57], value for money [20][48], general risks, contamination [58], and perceived safety. These could potentially cause negative trade-offs for consumers which should be addressed by manufacturers [56]. The functional expectations of the product are decreased when a consumer perceives the product as sustainable or recycled [22]. Recycled items are also often perceived by consumers as less attractive than the same product made of virgin materials [57]. Perceptions of contamination can also negatively influence how consumers perceive circular products made with the recycled components in some instances [58]. Contamination causes discomfort or disgust when using products that contain previously used (recycled), which could be caused by the appearance of the product, for example, recycled PET bottles are less clear and could have potential contamination risks. This also leads to a negative perception of safety in consumption. This perception of the contamination is mainly emphasised for products that are directly in contact with food or drinks or in contact with skin (for example, a coffee machine, water bottles, skincare packaging).

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2.3 Sustainable Consumer Segmentation

The section discusses the literature of target segmentation, as well as approach and intervention strategies towards the chosen segment. This section formulates and introduces Circularise's potential target consumer.

People are extremely diverse in value and prioritize, which also applies to sustainable behaviours. To arrive at a better understanding why people do or do not behave sustainably, and to design effective interventions to promote sustainability, it is useful to distinguish different profiles in the population.

A framework from literature leads to brief user segmentation before the interview [36]. According to Verplanken, sustainable users can be segmented to four different quadrants according to the axes of the user's opportunity and motivation to act; the four segments are (high potential, willing), (high potential, unwilling), (low potential, unwilling), and (low potential, willing) [36].

The 'low potential, willing' segment consists of people who are motivated to make sustainable choices, but are limited in what they are able to do. This group requires support that could match with Circularise's offering. Interventions are required that support, lower barriers or reveal opportunities. This could involve providing better infrastructures, namely, easier access to sustainable products and services. This segment's role in community-based interventions is more as participants rather than leaders, who may be encouraged to make sustainable choices.

Approach

this 'low potential, willing' segment needs to overcome barriers to change while already having higher levels of motivation to explore possibilities. They should be provided with support, lower barriers or reveal opportunities, provide better infrastructures, such as more accessible to sustainable products and services. Habit-discontinuity-based interventions also influence them to explore opportunities to implement sustainable goals [36].

Further research is done on who these low potential and willing users are to formulate the group of target consumers.

Target consumer

According to demographic trend research, Generation Z is the generation that is well-familiar with the concept of sustainability. This generation has grown up in a hyper-connected world [59]. Transparency plays a significant role in accessing and processing new information since they value stability and trust, and authenticity on the internet is a significant factor for Generation Z. To generation Z, customer satisfaction scores through various factors, including reliability, responsiveness, and relationship [59].

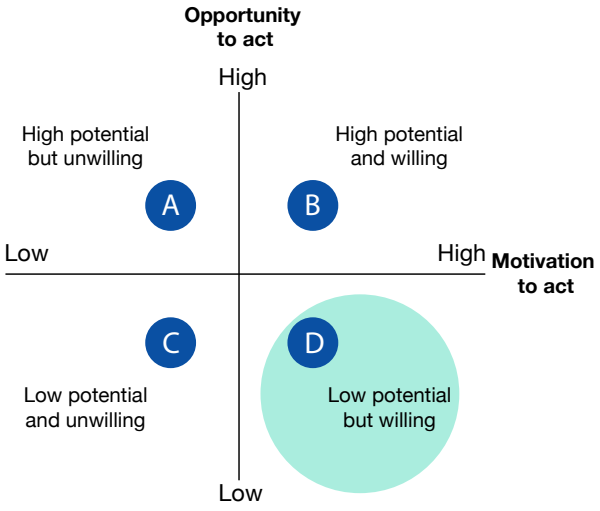

Figure 2.3 Sustainable consumer segmentation axes based on Verplanken [36]

[52] Grönman, K., Soukka, R., Järvi-Kääriäinen, T., Katajajuuri, J. M., Kuisma, M., Koivupuro, H. K., ... & Thun, R. (2013). Framework for sustainable food packaging design. Packaging Technology and Science, 26(4), 187-200.

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[62] McKinsey 'True Gen': Generation Z and its implications for companies. - Available online: https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/true-gen-generation-z-and-its-implications-for-companies. (accessed on Mar 6, 2020)

Generation Z and sustainability

Generation Z is well-familiar with the concept of sustainability [59]. Forbes 2019 report, "The State of Consumer Spending: Gen Z Shoppers Demand Sustainable Retail," notes that 62% of Generation Z, who will begin entering the workforce, prefer to buy from sustainable brands, which is on par with their findings for Millennials[60]. The majority of Generation Z in this report (54%) are willing to spend 10% or more on sustainable products. 59% of Generation Z is buying upcycled products, which are made from discarded objects and materials to create a product of a higher quality or perceived value compared to the original.

Generation Z and trust

Generation Z is the generation that has grown up in a hyper-connected world [61]. Therefore, transparency plays a significant role in accessing and processing new information since they value stability and trust [61]. Authenticity on the internet is a significant factor for Generation Z [61]. According to McKinsey research, the main spur for generation Z to consumption is the search for truth in both a personal and a communal form. Its search for authenticity generates greater freedom of expression [62]. Gen Z consumers are mostly well educated about brands and the realities behind them. When they are not, they know how to access information and develop a point of view quickly. If a brand advertises diversity but lacks diversity within its ranks, for example, that contradiction will be noticed. Deloitte surveyed 1,844 Gen Z globally in 2018 and shows that Gen Z feels there is a significant gap between a purpose-driven business and how they are operating. 75% believe businesses focus on their agendas rather than considering the society. Up to 46% of Generation Z-ers research a product on their mobile devices before making an in-store purchase. 73% of Generation Z-ers also say they would make a purchase based on a social media recommendation.

Generation Z and purchasing power

According to Nielson's demographic reports, Generation Z-ers have spent more than $143 billion annually, which is significantly higher than other generations at the same stage of life [63].

[63] WP Engine - Generation Z Buying Habits & Purchasing Power Available online: https://wpengine.com/resources/marketing-to-gen-z/ (accessed on Mar 6, 2020

[64] Deloitte Millennial Survey 2018 - Available online: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/gx-2018-millennial-survey-report.pdf (accessed on Mar 6, 2020

2.4 Conclusion

In this chapter, the literature was reviewed to understand user behaviour in sustainability, their process, barrier, their consideration of benefit and risks, and the underlying segmentation. These insights lead to user research in the next chapter. The conclusion of user behaviour insights is concluded as follows.

Recognisability influences WIP

Recognisability positively influences the willingness to purchase a price premium for products made of recycled plastic [32].

Measurability of the impact is essential.

In addition to recognisability, users also feel that sustainability is abstract, and their impact cannot be measured and there are no easy metrics to evaluate their sustainable actions [29][33].

Users do not trust the brand's self-claim of sustainability.

Gen Z feels there is a significant gap between a purpose-driven business and how they are operating [64]. 75% believe businesses focus on their agendas rather than considering the society [64]. 73% of Generation Z-ers also say they would make a purchase based on a social media recommendation.

The drive to use a sustainable product because of a symbolic value

Some individuals may prefer to use more sustainable products when they are consumed in public and therefore contribute to the personal image they wish to have [26].

Immediate over long-term interest

Sustainable behaviours often face the challenge of a conflict between immediate self-interest and longer-term collective interests since sustainability is perceived as something abstract and for the future [36] [37].

The factor of being in control

Sustainable behaviours are also highly influenced by perceived behavioural control consists of self-efficacy, which is the extent to which the performance is up to the person who acts it [39]. Perceived lack of control may prevent someone from behaving sustainably while feeling in control may motivate a person, and driver behaviour [40].

Habit and conscious decision

Some consumers were aware of the sustainability aspect but failed to remind themselves of it at the time at which action was needed [45] If an action has been repeated sufficiently, a conscious behaviour or decision is not needed. The action will be taken automatically when the situation occurs [45] Up to 46% of Generation Z-ers research a product on their mobile devices before making an in-store purchase. 73% of Generation Z-ers also say they would make a purchase based on a social media recommendation..

3

Blockchain, Trust, and Sustainability

This chapter divides into three sections. The first section explains general information about Blockchain technology and how it enables supply-chain transparency with the case of Circularise, who is providing supply-chain transparency for businesses. The second section addresses several challenges that prevent end-consumers from adopting blockchain technology to define opportunity and challenges in applying blockchain to the consumer segment. The last section concluded the insights and value that blockchain and supply chain transparency could provide for end-consumers.

3.1 Blockchain and supply-chain transparency

This section explains general information of Blockchain technology and how it enables supply-chain transparency.

Why Blockchain?

Blockchain is evident in assisting businesses to reach sustainable development goals around supply chain traceability [65], ethical sourcing [65][66], food freshness [66], and more. The technology provides a trusted record of data which was unlike any other systems [66].

Currently, most supply chains rely on the organisation's stand-alone information management systems. For one single organisation to store sensitive and valuable information, stakeholders require significant trust [67], and the information is also vulnerable to tampering, error, or corruption [68]. With this centralised characteristic, the businesses faced an inability to share information in a transparent, trustworthy, and immutable manner [66].

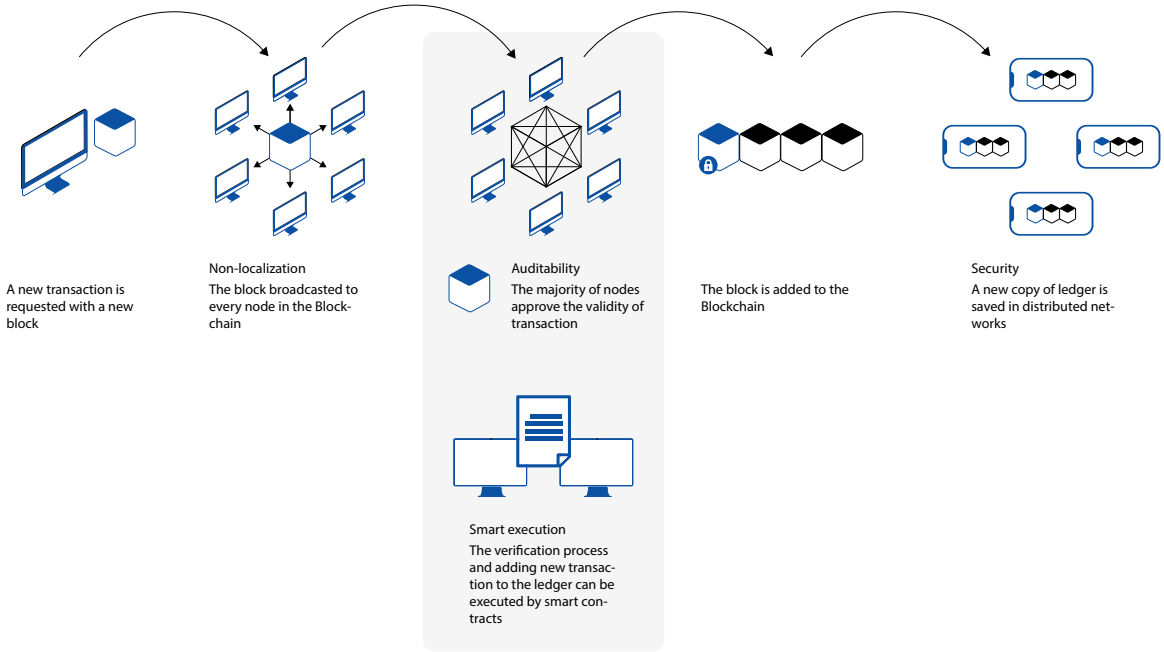
Blockchain allows confirming and verifying that processes, products, and activities in the supply chain meet the sustainability criteria and certifications, which is an essential strategy for sustainability in supply chains [3] This reveals the potential that consumers could reach valuable data that was impossible to obtain or trust, and strengthened their roles in the circular economy in the future.

What is Blockchain?

Blockchain is a decentralised database, which stores a registration of assets and transactions across a peer-to-peer network. Blockchain technology was first introduced as the underlying technology of the Bitcoin cryptocurrency [69]. It ensures that a digital token (namely, Bitcoin) could not be spent more than once (double-spending), which was a problem of the digital economy [69]. The Internet move information, not value. The information (asset) that was moved is also a duplicate and not the original one [65]. Unlike the internet, blockchain does not duplicate the transferred asset. It registers that an asset has been transferred from one actor to another across a network [65]. The asset can be many things, namely, money, ownership, contracts, products, personal identity information, and sustainability claims of materials [13][65].

The four key characteristics of Blockchain information and transaction steps are decentralisation, auditability, smart execution, and security (figure 3.1)[65].

Figure 3.1 (below) The four key characteristics of Blockchain information and transaction steps (based on Zwitter & Herman, 2018) [65]



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[67] Abeyratne, S. A., & Monfared, R. P. (2016). Blockchain ready manufacturing supply chain using distributed ledger. International Journal of Research in Engineering and Technology, 5(9), 1-10.

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[70] English, M., Auer, S., & Domingue, J. (2016, May). Block chain technologies & the semantic web: A framework for symbiotic development. In Computer Science Conference for University of Bonn Students, J. Lehmann, H. Thakkar, L. Halilaj, and R. Asmat, Eds (pp. 47-61). sn.

[71] IBM - What is blockchain technology? – Blockchain for dummies. Available online: https://www.ibm.com/account/reg/th-en/signup?formid=urx-16905. (accessed Mar 2020)

Decentralisation

When someone wants to create and add a new transaction to the blockchain, it would be broadcasted to every node in the network for verification [65]. Blockchain functions without any central control system (non-localisation), the validity of this new transaction has to be agreed by all participants (nodes) for a transaction to be valid [65].

Auditability

When a new transaction is created and broadcasted to every node in the network, it also involves auditability. This is the process that All participants (nodes) in the network has to approve this transaction. The approval is, according to pre-specified approved rules [65].

Smart Execution

The smart contract is a critical feature of blockchain technology. It enables credible transactions to be performed without third parties' involvement [65]. The verification process and adding a new transaction to the ledger is executed by smart contracts [65].

Security (Provenance and Immutability)

Lastly, this new transaction is added as a new block to the chain. For security, It is saved in several distributed nodes, which means that multiple copies are created and distributed in a decentralised way to create a trusting chain [65]. The value is represented in transactions recorded in a shared ledger and secured by providing a verifiable, time-stamped record of transactions [70]. Participants know the origin of the asset and see when the asset's ownership changes over time [71]. However, a participant cannot tamper with a transaction after it has been recorded. If there is an error in a transaction, another new transaction must be created to correct that error. After that, both transactions would be recorded and visible to all participants [70].

Blockchain allows a broad range of applications in different industries, namely, currency and financial services, property and ownership, supply chain management, identity management, and governance [65][72]. The next section concludes how blockchain brings transparency to the supply chain and value to the circular economy.

Transparent supply chain

The characteristic of blockchain technology mentioned previously enables three main elements in supply chain management which are transparency, traceability, and security [10]. By recording the transactional data throughout the supply chain, blockchain enables traceability from the origin of material to the retail store [65]. This allows confirming and verifying that processes, products, and activities in the supply chain meet the sustainability criteria and certifications which is an essential strategy for sustainability in supply chains [3]. The detailed process in actual practice would be explained by using the case study of Circularise, according to an interview with Mesbah Sabur (a founder) and the company's white paper [13].

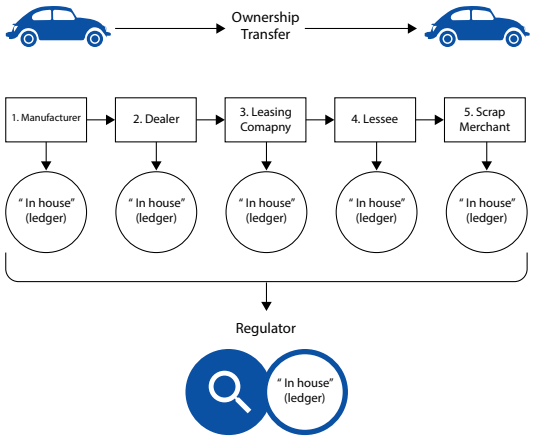


Figure 3.2.1 The supply chain without blockchain (based on Circularise [13] and IBM [71]

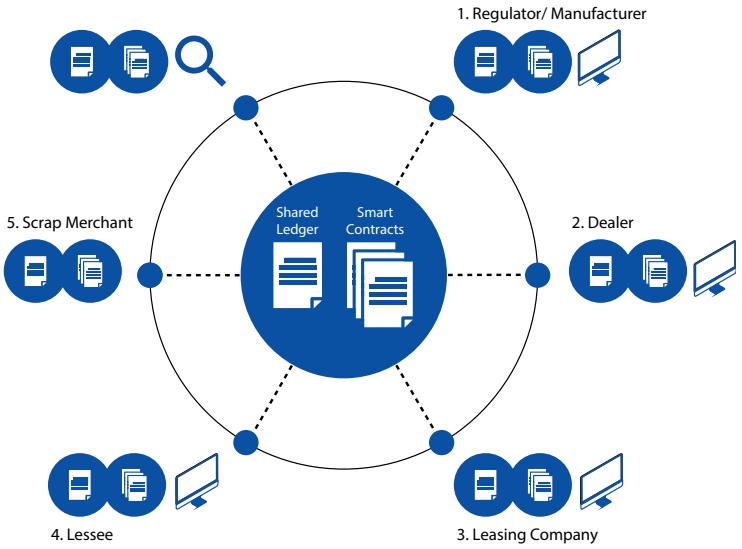


Figure 3.2.2 The supply chain with blockchain (based on Circularise [13] and IBM [71]

[72] Elsden, C., Manohar, A., Briggs, J., Harding, M., Speed, C., & Vines, J. (2018, April). Making sense of blockchain applications: A typology for HCI. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-14).

[73] Circularise, Covestro and Domo showcasing plastics traceability solution at CES 2020 - Available online: https://www.covestro.com/press/circularise-covestro-and-domo-showcasing-plastics-traceability-solution-at-ces-2020/ (accessed Jan 10, 2020)

Circularise is a public permissionless blockchain service to verify sustainable claims and connect communication of the claims throughout the supply chain [13]. Currently, Circularise has collaborated with several plastic manufacturers, namely, DOMO and Covestro, to certify recycled content, and they currently involve OEMs in pilot projects to connect the supply chain [73]. The current Circularise's customer journey starts with the plastic manufacturer registering with Circularise and with the first entry fee. Plastic manufacturers connect internal SAP ERP (Enterprise resource planning) to Circularise Web application, which includes recycled plastic certificates. Every 1 kg of the material batch is equal to 1kg of material in the blockchain system (Token). They could select external auditors to verify the material and complete the digitised certificate.

When a batch of material is transferred, the plastic manufacturer also sends digitised material batch in Circularise's web application together with the actual material to part manufacturer and OEMs. Lastly, OEMs that have already registered with Circularise to access the platform. They will receive the materials with checkboxes that are pre-checked by auditors. OEMs use these verification data internally to check that they are meeting their sustainable goals.

With blockchain, tracing the ownership and material certifications are simpler since every participant (nodes) share a record of asset transfer [71]. Furthermore, with smart questioning mentioned in Chapter 1, Circularise allows participants to ask for some material specifications with freedom for the material's manufacturer to choose the answers as an exact number, range, or

3.2 The Challenges for end-consumer to adopt blockchain technology.

While blockchain is becoming popular among businesses nowadays, it is not common now that mainstream consumers adopt blockchain. This section looks into challenges in blockchain adoption for consumers.

The user adoption of Blockchain technology is hindered by issues regarding usability and user experience [74].

Lack of Motivation to change

Problem

An average user feels satisfied with standard web-based services for communication, banking, or entertainment. Mainstream users do not see the need to change into blockchain platforms, for example, from Facebook to Steemit* [74].

Solution

- Communicate and offer recognisable user benefit and motivation to change [74].
- Make people aware of the difference between blockchain services and centralised internet services. The decentral ised web is defined by the following standards of Persistent, Not-Corruptible, Privacy-Focused, Fault-Proof, and Future-Proof [74].
- Make the interface easy to use and accessible for everyone to own and manage their digital identity in a decentralised web [74].

Onboarding challenge

Problem

Most available information is targeted for people with a higher degree of technology affinity, for example, software developers. For mainstream users, the major pain point is when starting to learn. It takes time and emotional frustration to complete the tasks they need, which make users easily lose interest [74].

Solution

- Develop an understanding of users' onboarding process and barrier to provide the information that users need to increase their knowledge about the technology [74].
- Focus on adoption phase and educate users. Develop a beginner's guide or user tool while using [74].
- Use the complexity as an advantage to spark the user's curiosity [74].

Usability problem

Problem

The majority of developers of blockchain services focus on functionality, maintenance and stability and not in usability, efficiency and accessibility [74]. This leads the user to be frustrated.

Solution

The solution could be starting from standard interaction patterns or focus on experience from the start. Use MVP to test on usability along the developing process[74].

Feature problem

Problem

The logic of truly decentralised technologies does not have a central authority; therefore, some standard usability function is not enabled, e.g. resetting passwords. This is among other problems that users have to be aware of and get familiar before registering [74].

Solution

The solution could be turning constraints into assets that the personal user data is genuinely secure this way and communicate of this risk of not restoring passwords [74].

[74] Glomann, L., Schmid, M., & Kitajewa, N. (2019, July). Improving the Blockchain User Experience-An Approach to Address Blockchain Mass Adoption Issues from a Human-Centred Perspective. In International Conference on Applied Human Factors and Ergonomics (pp. 608-616). Springer, Cham.

3.3 Conclusion

Values that Blockchain and Circularise provide to consumers

The values are concluded according to the insights provided in this chapter about blockchain and supply chain transparency, and the insights of Circularise's value proposition for business clients in Chapter 1.

Trust

Blockchain is reliable and secure. It can be trusted to clarify and transfer assets and prevents ownership from being manipulated or double-spending.

Not risking privacy

Blockchain is pseudo-anonymous. The participants are verified uniquely using individual pseudonyms, but real-world personal identities do not need to be revealed.

Decentralisation

Information is not in the hand of a single actor or brand. No single individual can dictate the content of the blockchain alone.

Digitised Certificates

Digitised Certificates are the digitalisation of certificates of recycled content. Circularise can provide sustainable claims of recycled plastic material for every batch of product manufactured. This ensures that the product's component comes from recycled plastic parts. It is traceable who provided the information and who is the auditor that authorised the claim.

Product passport

Product Passport is currently used by manufacturers and OEM to communicate information about products. Product passport could be the way to connect consumers with the digitised information of the product. QR code and RFID are the possibilities to connect consumers from product or store touchpoint.

Smart Questioning

Smart questioning is an automated system to understand product content and composition. Circularise could apply the smart questioning for consumers. This would give freedom to consumers to ask questions about the materials in the products.

Connection with the supply chain

Currently, Circularise has a connection with recycled plastic manufacturers, part manufacturers, OEMs, and brands. This could allow consumers to trace the product's origin, or provide supply chain information that supports their purchase decisions. If the value is evident and mutual, these stakeholders of the supply chain could be linked together with end-consumers to achieve a circular economy together. This would empower the voice of consumers in sustainability.

The assumption to be proven in the user test

By providing trustworthy data throughout the supply chains, consumers would trust sustainable claims more.

4

User Research

The previous chapters lead to several questions and assumptions to be explored further. This chapter describes studies of target users via interviews and group sessions. The goal of the user research aims to gain insights about needs and values, which enables design vision and design criteria.

Recap of Takeaways from previous chapters

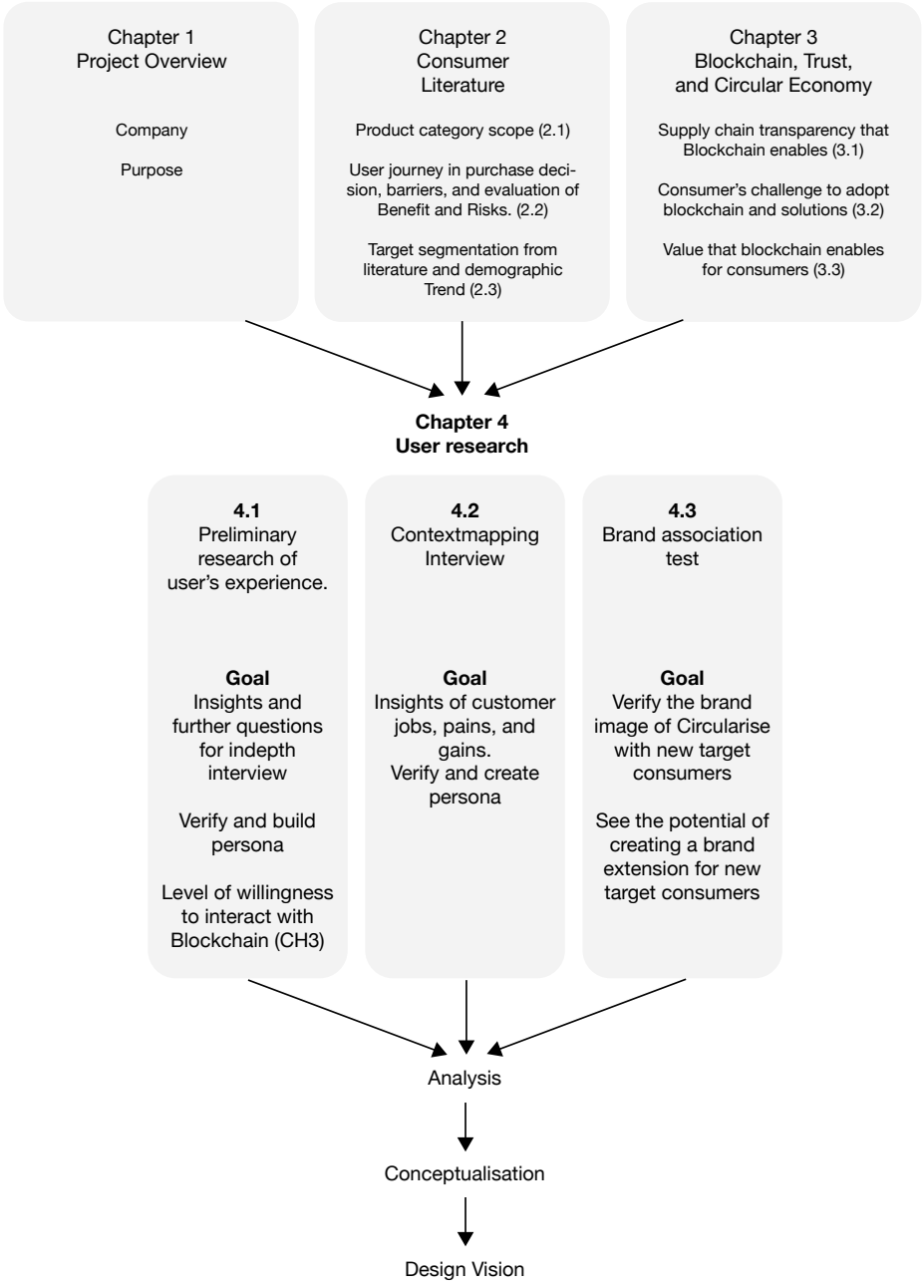


Figure 4.1 Recap of takeaways from previous chapters.

Studies were performed with the target users and Circularise by interviews and creative sessions as follows;

(4.1) A questionnaire to gather target users' preliminary insights for their needs in purchasing sustainable recycled plastic products, and level of acceptance of blockchain adoption to gain sustainability support

(4.2) user interviews aimed to understand individual insights with the question developed from literature and 4.1

(4.3) an interview about the brand association to check Circularise's current visual language (for B2B clients) and verify the potential need to create a specific visual identity for new target consumers.

4.1 User experience study

Goal

According to the insights from Chapter 1-3, an online questionnaire was created with several goals. Most importantly, the overall goal is to gather insights to verify the persona, including perception of sustainability. From chapter 2, a user segmentation arrived from literature and demographic trend research. This research will provide preliminary insights that lead to in-depth questions for later user interview (4.2).

The second goal is to identify the information that users want to know to make a purchase decision of recycled plastic products. After providing the information from the literature that blockchain could provide transparent supply chain information, the question triggered the users to think about what they want to know to make a purchase decision.

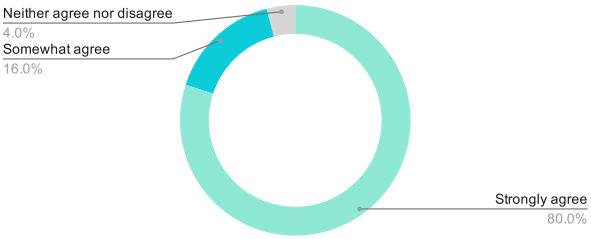
The third goal is to identify the trust in sustainability claims by brands and third parties. According to chapter 3, users feel a lack of motivation to adopt blockchain since they are satisfied with standard web-based services, and it takes more time to complete the tasks they need [74]. The last goal is to understand our target user's level of willingness to adopt blockchain to gain support in making a purchase decision for sustainable products.

Method

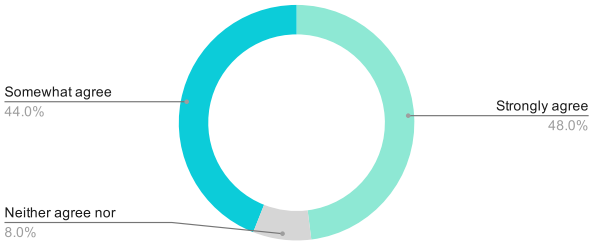
An online questionnaire was sent to participants (n = 25) who were preselected to be within the target persona, employing the purposive sampling. The participants were informed of the goal of the research and were given essential facts from literature about how Blockchain supports circular economy along with other definitions. (See full questionnaire at appendix II). The results were collected, clustered, and labelled to understand the pattern.

Finding 4.1.1

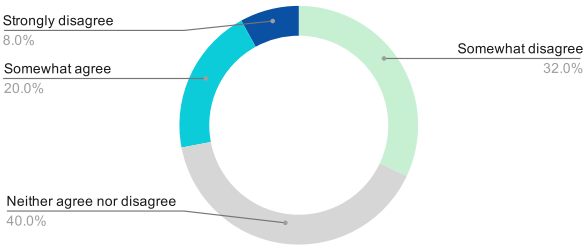
Among these 15-25 years old (Generation Z), 96% percieved that sustainability and circular economy is important and urgent.



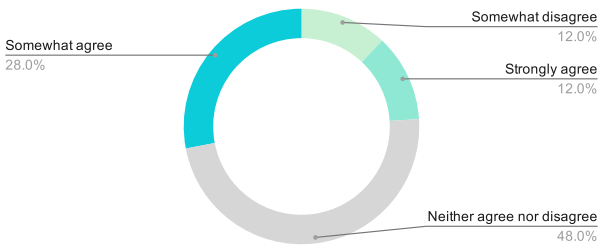
92% of the target consumers want to know their current sustainable impact.



Only 20% somewhat trust claims of sustainability from the brand that own products and not have sustainability as their core.



While 30% don't trust the brands and trust the third party verifications of sustainability. 48% of participants were unsure who to trust



The reasoning behind these answers was provided in findings 4.1.2 - 4.1.4.

→ This finding leads to developing the persona in Chapter 5

4.1 User experience study

[75] Konietzko, J., Bocken, N., & Hultink, E. J. (2020). A Tool to analyze, ideate and develop circular innovation ecosystems. Sustainability, 12(1), 417.

Findings 4.1.2
The information that users want to know to make a purchase decision for recycled plastic products.

The insights were clustered and arranged according to the product level, business model level, and ecosystem level framework [75]. This framework was based on 'A tool to analyze, ideate, and develop circular innovation ecosystems', which stated that radical changes in product, business model and ecosystem innovation is required to implement a circular economy program [75]. The framework was visualised with mapped responses in figure 4.1.2.

Product level

In the product level, the first cluster represents 52% of users who want to know the recycled plastic components.

The target users want to understand the recycled component of plastics, material information, and the amount of material and resources saved by using recycled plastics.

Example of responses

"I want to know the materials, I would like to see that the company is really trying and honest about"

"I don't know much about the supply chain, maybe the materials it uses. As materials seem to be the most familiar things"

The second product-level cluster represents 16% of users who want to know the impact of the materials.

Users want to understand the material's impact and consequences to the environment in the whole product.

Example of responses

"Information about which materials are used and their impact on the environment."

"I wonder if there's actually going to be a positive impact in the end."

Business model level

In the business model level, 16% want to see overall carbon footprints. Another 16% are interested in energy consumption, transportation, and other pollution while manufacturing.

Example of responses

"how many energy/resources they saved and what does that mean to nature and our society"

"Production always requires energy, so if the factory is specifically eco-friendly/ uses renewable energies, I'd love to hear that! "

24% requires to know the labour condition in manufacturing the product and their social benefits.

Example of responses

"What the material, where it comes from and if people who worked on it are in safe conditions."

"Human aspect, if people are payed a living wage"

Ecosystem level

16% aims to learn the supply chain how each part is produced and who produced it.

Example of responses

"What materials are exactly in a product and how and where they are produced."

"Sustainability (CO2, water usage, material usage, pollution etc) in the supply chain"

8% are interested in the source of each material.

Example of responses

"I'd like to know more about the source of the raw material "

Another 8% are interested in the recycled process to produce the recycled material in the product.

Example of responses

"I want to know the most about recycling and reusing of materials, and how that applies to a certain product."

Participants also see the importance of learning the labour condition of the whole supply chain.

Example of responses

"I want to know the working conditions of people who were involved in the supply chain"

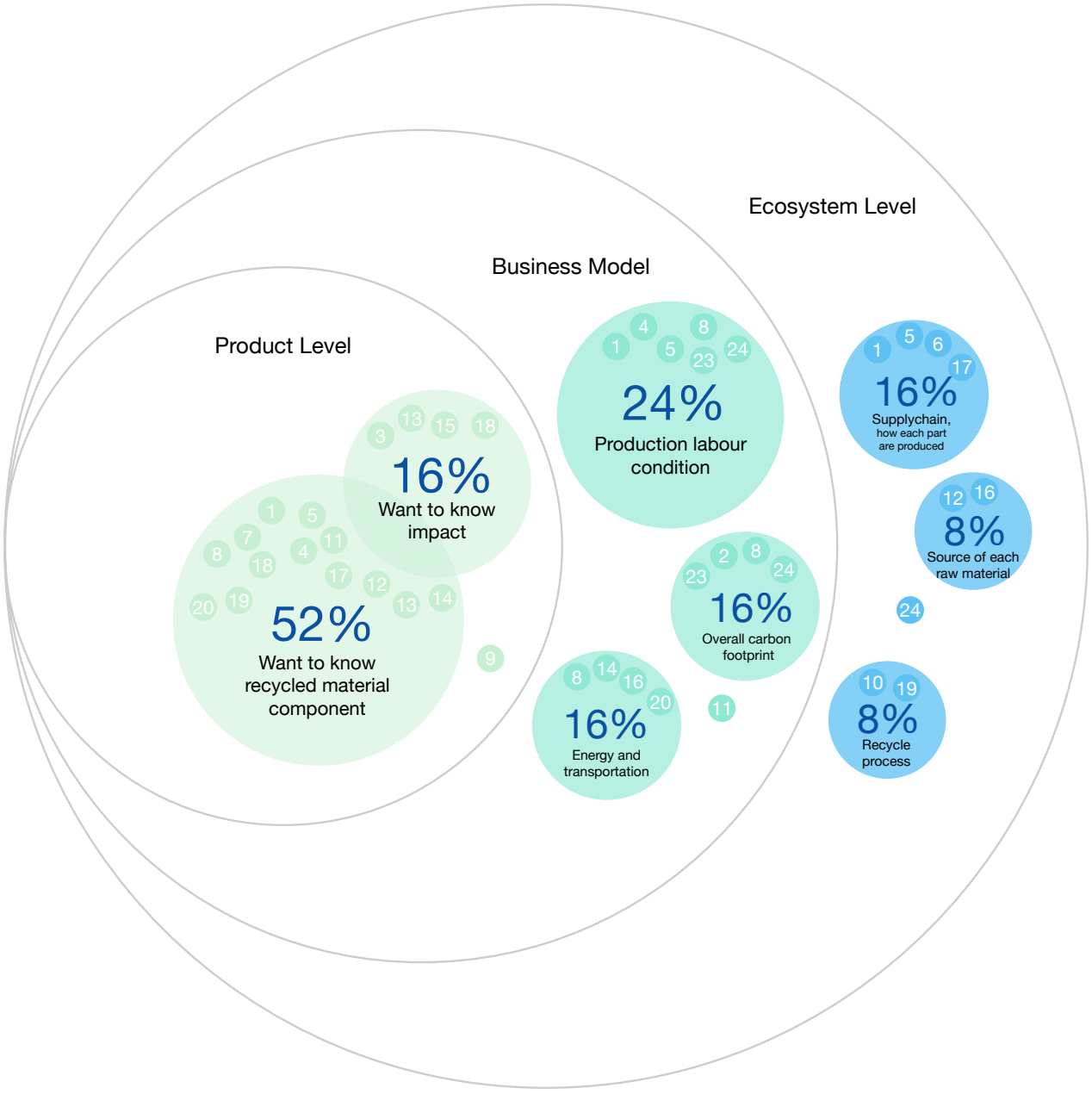


Figure 4.1.2. Data visualisation of findings with each numbers representing the participant's number.

4.1 User experience study

Findings 4.1.3
The trust in sustainability claims by brands and third parties.

8% of users trust the sustainability claims of products by product's brands because it's mandatory for brands to protect their own reputation, and that third party is not always trustworthy.

76% trust the sustainability claims of products by third parties. This group consists of many clusters with a similar amount of importance as follows.

The numbers in figure 4.1.3 represents each participants. Some participants provided more than one responses..

Impartial and Independent

Users believe that third parties are trustworthy as they are impartial. They are independent and not connected to the brand. They are not partners for marketing purpose and doesn't gain direct profits. There is no financial gain involved.

Example of responses

"Third parties, have the possibility to be a neutral party. I would rather trust an independent neutral party"

"I would also concern that the 3rd party and the company product are actually partners and sharing the same interest."

"I only trust third parties that have no connection to the company. There must not be an interest involved in it."

Evidence and Investigation

Users trust the third parties if they can investigate, and they are provided with evidence regarding the third party's information, how they trace the brand's products and show proofs or evidence that they are not a marketing tool.

Example of responses

"Sustainability has been a powerful marketing strategy...why should I trust a third party if there is no evidence."

Good reputation and Official

User trust the third parties that are official and have a good reputation, they have to be certified, the government, NGOs, or professional well-known labels that already rate multiple brands.

Example of responses

"If the 3rd party has a good reputation, then I would tend to trust it more."

"I think a third party (for instance, government or sustainable global organizations) are more professional in sustainability"

Others

Users believes that brands and third parties can work together since they have a shared reputation and own to protect.

→ These findings lead to the criteria in the strategic positioning of Circularise as a third party in Chapter 5.

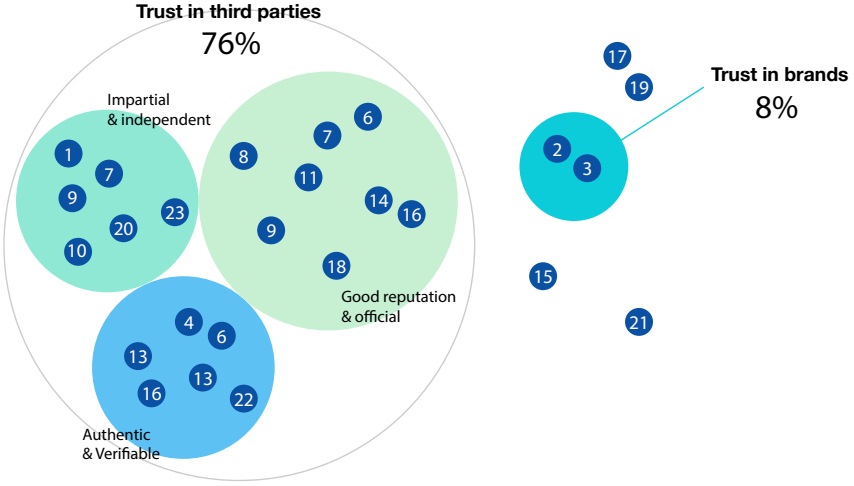


Figure 4.1.3. The visual of clusters of responses.

4.1 User experience study

Findings 4.1.4
Willingness to adopt blockchain and level of interaction

Blockchain value for transparency of the supply chain is trusted, but the blockchain platform is not user-friendly.

Among 25 participants, the clusters are as follows:

36% prefers to see a label on the product that it's traced by blockchain technology, and they can look for more information if they want to.

32% prefers to find the product's supply chain information that's traced by Blockchain to understand the product's origin and story.

8% prefers to have both label and supply chain information.

12% prefers to adopt blockchain technology and learn how tracing works.

The last 12% mentioned that they don't know how Blockchain works and it's complicated to adopt.

Example of responses

"It would be very effort consuming that I need to check the blockchain info of every product that I use. I am super lazy. So I would prefer it if someone tells me that it is good. By some 3rd parties that I trust." a target user's response.

"I think the effort should be minimal." a target user's response.

The finding supported insights from Chapter 3 about blockchain adoption. According to the users, there are technological barriers since users have limited general knowledge of blockchain, and this is not a good selling point for Circularise to introduce to early adopters.

While users want to obtain the value that blockchain provides, which is transparency in the supply chain.

However, from the finding 4.1.2, the consumers are interested to know and track supply chain information, so they could be more empowered from being part of the blockchain platform.

Since this will take time for them to understand and trust the system, more interaction with blockchain could be introduced after more engagement with target users, which could be in the middle term or long term strategy.

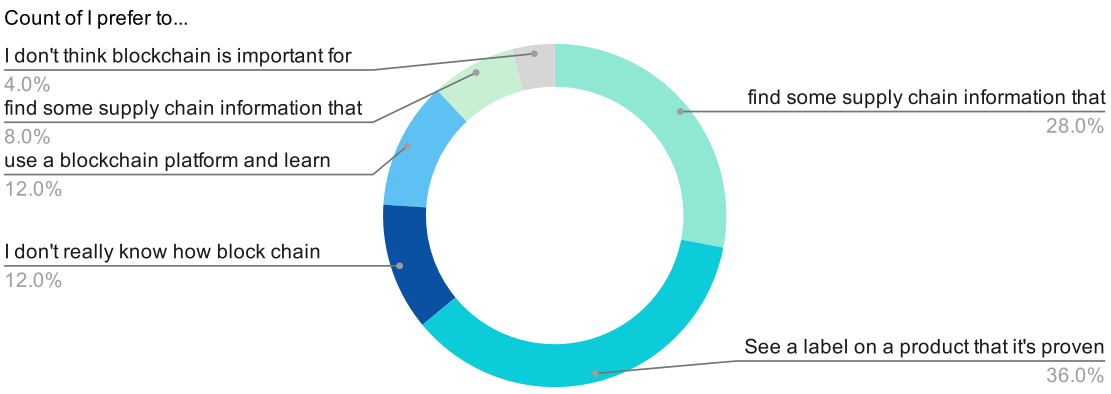


Figure 4.1.4 The result of consumer's willingness to adopt blockchain and level of interaction

4.2 Interview

With the insights from findings 4.1, the interview guide were created to dive into reasoning behind the insights. The context mapping method was chosen since it guides the users to recognise their own experience [76]. The questions were arranged from now to the past, and future (dream) which leads to richer insights [76].

Method

A mixed-method approach was used during the interviews. A semi-structured interview guide was created [77]. We used the context mapping method and sensitising booklets to sensitise the participants towards the interview topic [76][78].

Sample description

According to literature reviews and goal of the project, the purposive sampling is conducted by selecting the target group concluded from 4.1.1 insights. The target group belongs to generation Z and perceived sustainability as important and urgent. They have a high awareness but not in particular about recycled plastic products. Most users are continuously adjusting their sustainable activities and strive for development.

For a qualitative interview, 9 users (3 Males, 6 females)(5 dutch and 4 international) were selected based on their age range within generation Z, which was 1995-2010 [79].

Limitation

Due to the outbreak of coronavirus, the interviews had to be conducted online and it would be inconvenient to create paper probes (booklet) or had the interviewees use them. Therefore, the sensitizing booklet was initially withdrawn from the project. However, during the pilot interview, we realised that the users would still need and benefit from probes to reflect their actions more in-depth before the interview conversation.

Sensitising Booklet

An online sensitising booklet was created with inspiration from Context mapping method. The sensitizing booklet is used to make users sensitive with the topic-related questions [77][78]. It's usually printed as a booklet and sent to users a week before the interview, with one exercise each day. The exercises are from easy to the one that needs more thoughts. the booklet was created to match the target users by creating individual google slides for each user, so they can do the exercise, share, and adjust even during the interview. This allowed them to express ideas in digital format, add images (replacing stickers in a paper probe), add sketches, and text with unlimited fonts and colours. The interviewees are informed that they can have full freedom with the booklet, they can work in google slides directly, or print or write the answers down on paper and send photos if they prefer. See the example of filled booklet in appendix III.

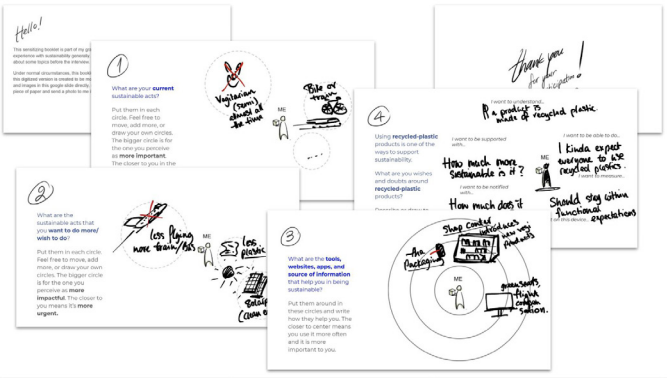


Figure 4.2.1 The sensitising booklets

Process

The interviewees were asked, informed about the booklet, duration of the interview and interview goal (but not the project's goal). The booklets were shared online five days ahead of the scheduled interview day with one assignment each day. We can see the booklet is completed in real-time and use it to foster conversation during the interview. At the beginning of the interview, the booklets were checked for completeness. The interview is done via calls while using the interview guide and sensitizing booklet to guide the conversation. The participant was briefly informed about their anonymousness and how the data would be used, in addition, the permission to record the audio was requested. The interviews were held in an individual manner. Despite the fact that it has been very time consuming, individual interviews allowed the users to express their opinions in depth. Each interview had approximately one-hour long and revolved around the booklet and the questions from the interview guide. The participants were invited to talk about their booklets, pointing at different important reflections, and answered some questions about each part. The questions aimed to tackle the interviewees' experience, opinion, feelings and knowledge and time-framed to approach past, present and future thoughts on the topics [76][78].

[76] Sanders, E. B. N., & Stappers, P. J. (2012). Convivial design toolbox.

[77] Patton, M. Q. (2002). Qualitative interviewing. Qualitative research and evaluation methods, 3(1), 344-347.

[78] Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005). Context-mapping: experiences from practice. CoDesign, 1(2), 119-149.

[79] Francis, T., & Hoefel, F. (2018). True Gen': Generation Z and its implications for companies. McKinsey & Company.

Interview guide

The interview guide was used while interviewing together with the filled-out sensitising booklet. See the full interview guide in Appendix IV, The follow-up questions are listed in bullet points.

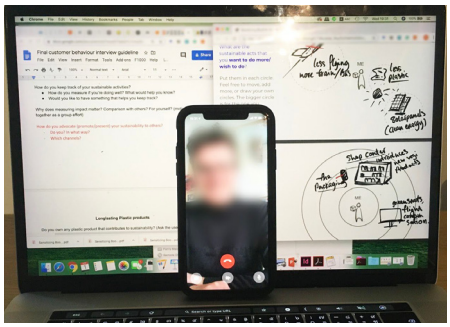


Figure 4.2.2 An interview via video call with the sensitising booklet and interview guide

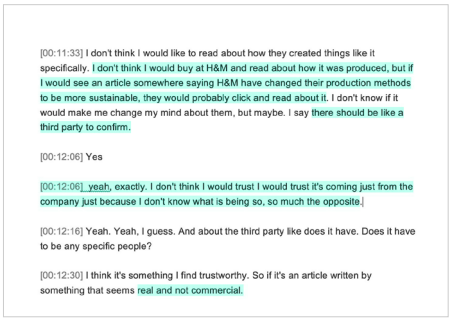
Analysis

The interviews were transcribed and coded in a mixed-method approach referencing the context mapping method [76] and the grounded theory method (three-level coding) [80].

Analysis Process

The interview conversations were transcribed in text. The quotes with relevance insights were selected and highlighted with different colour-code for each interviewee. The selected quotes are added in statement cards with our interpretation [76] to identify the quotes that are associated with each key insight. A three-level coding was conducted instead of the standard print-out process in context mapping as a clustering method of selected insights [80]. The clusters were then put together and reorganized to identify how they are related to one another.

[80] Birks, M., & Mills, J. (2015). Grounded theory: A practical guide. Sage.



[00:11:33] I don't think I would like to read about how they created things like it specifically. I don't think I would buy at H&M and read about how it was produced, but if I would see an article somewhere saying H&M have changed their production methods to be more sustainable, they would probably click and read about it. I don't know if it would make me change my mind about them, but maybe. I say there should be like a third party to confirm.

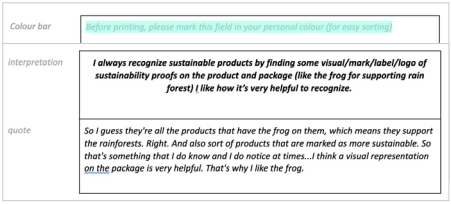
[00:12:06] Yes

[00:12:06] yeah, exactly. I don't think I would trust I would trust it's coming just from the company just because I don't know what is being so, so much the opposite.

[00:12:16] Yeah. Yeah, I guess. And about the third party like does it have. Does it have to be any specific people?

[00:12:30] I think it's something I find trustworthy. So if it's an article written by something that seems real and not commercial.

Figure 4.2.3. Image of transcribing and highlighting



Colour bar: Before printing, please mark this field in your personal colour (for easy sorting)

Interpretation: *I always recognize sustainable products by finding some visual/mark/label/logo of sustainability proofs on the product and package (like the frog for supporting rain forest) I like how it's very helpful to recognize.*

quote: *So I guess they're all the products that have the frog on them, which means they support the rainforests. Right. And also sort of products that are marked as more sustainable. So that's something that I do know and I do notice at times...I think a visual representation on the package is very helpful. That's why I like the frog.*

Figure 4.2.4. An example of a statement card with quote, interpretation, and colour bar.

Findings

The key findings from each cluster were mapped on a user journey to see the pain and gain of each process from when the user becomes aware of the product until the purchase decision. The motivation and barriers are also mapped in this journey. The result will be shown at the conclusion part in the next page.

Figure 4.2.5. (below) The three-level coding with cluster (category), interpretation, and quotes

Interviewee name	Direct transcript	Interpretation	Category
R.G	see in the shop store by looking at available options and communication on pack	I search for products in the store to look at options and sustainability claims on packaging	Product discovery
R.G	with flying, there's like green seats. And that helps me to compensate my flights but also get a bit of insight on how much pollution there is per flight.	I fly green seats which gives me insight about the pollution I'm creating and how to compensate for it	Compensate the consequences
R.G	It's just this website where you fill in the flight that you're going to fly and then you can see how much it would cost to compensate that flight with co2 emission, so that you can actually pay them and they will invest in activities that will compensate your flight. So like better furnaces in Africa or somewhere	I can pay to compensate my CO2 emission and it will be invested in activities that compensate the emission	Compensate the consequences
R.G	A roommate of mine actually calculated this once. So he does sustainable energy technology and he calculated how much co2 a flight would image and how much it would cost to compensate with the right carbon price.	I got influence from my roommate who is studying sustainable energy technology, he calculates the carbon footprint and share with me	Peer influence
R.G	for those distances, I would love to take the train. But it's just not yet a viable option. Yeah. So the barrier is about the time that they take and is their time and the price	Barrier is the time and price that the sustainable option takes compared to the non-sustainable options	Barrier to be sustainable
R.G	But I would like to be more conscious about my energy consumption. if I would have that option, but that's it's not really a viable option right now. Yeah.	I would like to be more conscious about my energy consumption. if I would have that option	want to be more conscious
R.G	My idea about the recycled plastic is like every part of product should be made of recycled plastic. It should be done more.	Every part of product should be made of recycled plastic. It should be done more.	Support recycled plastic
R.G	But right now also, I think thing is I'm not sure what the impact is of recycled plastic	I'm not sure what the impact is of recycled plastic	Lack of awareness
R.G	What would be nicer to know maybe is on the other side. What if you buy a product and you dispose it? What happens with the plastic because I think the packaging itself for one product is really it's a really small piece. But if you add up all the plastics from all the products you buy then it's a lot.	Interesting to know where your recycled plastic comes from. What happen after you dispose it	Know origin and cycle of recycled plastic
R.G	I just think of plastics as the small plastics I buy for my food but not when it's when it's put into a big product. I don't really consciously see it maybe.	I have less awareness of big plastic products compared to FMCG	Lack of awareness

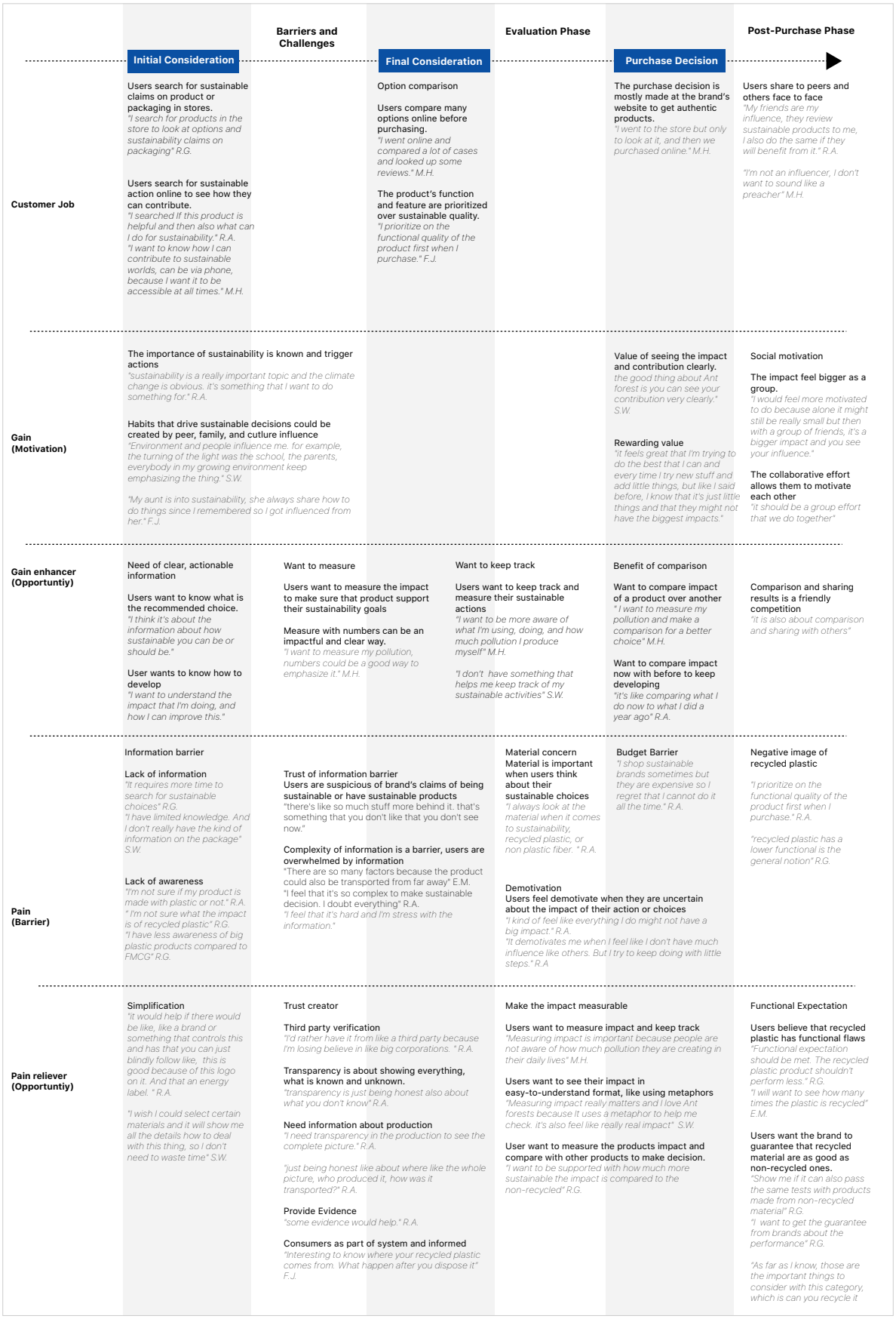


Figure 4.2.5. The customer journey with clusted insights

4.3 Brand Association

Since Circularise was mainly targeting business clients like manufacturers, government, OEMs, etc., the current brand identity communicates to those target users. An interview about brand association was conducted to see how the project's target users perceive the existing brand.

Goal

The goal is to see how Circularise's current brand identity and visual language communicates to our target consumers, and verify if there is the need to create a specific brand positioning and visual identity to better communicate with new target consumers.

Method

An online interview was done with 5 participants with a design background selected as representatives of the target group. The interviewees were checked that they did not know about Circularise beforehand. The interview was done via zoom.us with screen-sharing from the interviewer while asking questions about the brand visuals. Several visuals from Circularise's touchpoints, namely the pages in the website [11] and Circularise's application platform were shown (figure 4.3).

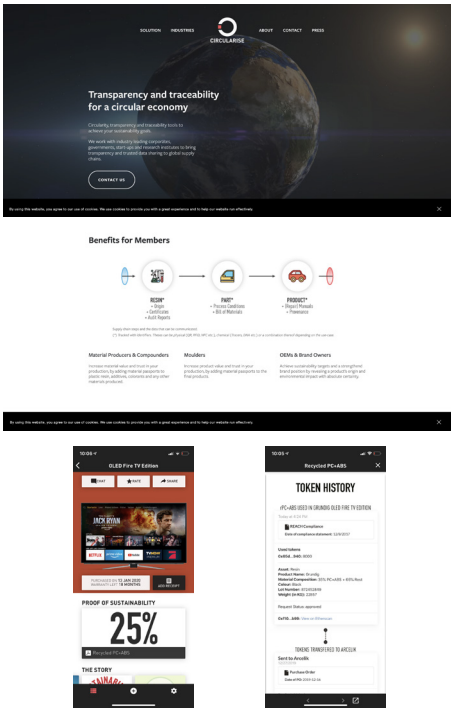


Figure 4.3 The visual of the home page on the website, the technology page, and Circularise's platform

The questions aim to verify what the interviewees associate the brand with. The questions are as follows:

Who is the perceived target audience of the brand?.

What does the brand do?

What is the perceived purpose it serves?

What is the recognised brand personality?

Does the touchpoint appeal to the participants?

With each answer, the participants also provided the reasons behind each answer.

Result

100% of participants understand that the brand associates with sustainability, international, global concern, and circular economy (from the name 'Circularise')

80% of the interviewees think that the brand's customers are business managers, owners, suppliers, and employees of sustainable organisations. Some reasonings are: The appearance looks serious and reliable on the main page. The description part looks simple (technical and design for function) and also for the platform. The content with the text about 'blockchain' 'supply chain' sounds technical.

The interviewees' responses concluded that Circularise's brand personality appears as professional (100%), serious (60%), technical (80%), but also not friendly for end-consumers (80%) and distant from interviewee's self (80%). Some quotes below from the participants supported their reasonings.

"I like that I can look into sustainable details of the product"

"This looks technical and maybe not something that I would use daily, maybe if I work for some organisation or doing some research." a target user's response.

"It is going to help me shop for things. It needs to be simple and fun." a target user's response.

"I don't need all the information. The purpose is not to get educated. what I need is to choose a product, a sustainable one." a target user's response.

"I'm not sure if I will be at ease to use this, I don't know much about blockchain" a target user's response.

4.4 Conclusion

The conclustions of each studies are concluded as follows

The target consumers perceived that sustainability and circular economy is important and urgent, and want to know their current sustainable impact. Most of them don't trust claims of sustainability from the brand that own products, but trust the third party verifications of sustainability, although some were unsure who to trust.

Information

The information required to make purchasing decision of durable recycled plastic products were concluded in product level, business model level, and ecosystem level.

For the product level, the target users want to understand material components, especially the recycled parts and the amount of virgin plastic material that's decreased by using recycled plastic material. They also want to know the consequence and impact that they will make by purchasing the product.

For the business model level, the consumers want to know the overall carbon footprints, energy consumption, pollution, and labour condition during manufacturing.

For the ecosystem level, the consumers want to learn about the supply chain how each part is produced, the location, and who produced it. They also want to know how the recycled material was made in the process. The labour condition of the whole supply chain is also an interest.

Trust

The trust elements that consumers require to make confident purchasing decision of durable recycled plastic products, and trust the claims that they are sustainable.

According to the findings, only a few percentages of target users trust in the brand's own sustainable claims.

76% of the participants trust the claims from third-party verifications because they are impartial, independent, and they need to protect both their reputation and the brand's reputation.

The consumers' concern is that the third parties have to maintain a good reputation, a professional image, and has already rated several brands. It's also important to be able to investigate their information, proofs, and trace the production process.

The third-party must remain independent and not receiving direct profits from the product's sale.

Level of interaction with blockchain

Most target users prefer to either see a label on the product that it's traced by blockchain technology and to find the product's supply chain information that's traced by Blockchain to understand the product's origin and story. The adoption of blockchain is considered overwhelming if only for purchasing sustainable choices.

User journey and insights

The user journey of the decision-making process to purchase durable recycled plastic products is concluded with the customer's job, gain, pain in figure 4.2.5. The journey is also added with what the users perceive as a possible gain enhancer and pain reliever.

Brand association

Although all participants understand what the current Circularise web application and platform is for, they perceived that the brand's customers are business managers, owners, suppliers, and employees of sustainable organisations. Since the appearance looks serious and reliable, technical and design for function. The content are also about 'blockchain' 'supply chain' which sounds technical to be a platform for end-consumers to make purchase decision for products.

5

Conceptualisation

This chapter describes the processes of conceptualisation, which is revisiting the initial identified purpose and problem statement, as well as using the insights to generate the final persona and positioning for Circularise. This chapter builds the ideas and solutions into a concept.

5.1 Persona

The smart-casual sustainable enthusiasts

Impact-focused truth verifiers who believe Blockchain tech has sustainable proof which can be investigated.

They don't want to know all information but want to get conclusion and make the right decision; trustworthy lightweight content - 'bite-sized format'

John, 21.

He is enthusiatic about sustainability growing up. His best friend also studies in sustainablity field and always exchange tips together.

John does what he can reduce waste, check for ethical-sourcing products, and reduce his overall carbon footprint by simple methods like using bike or train to travel. It makes him feels happy because he is contributing for the rest of the world.

John is not an activist but he casually joins events that's simple but contributes to the environment, like cleaning the beach.

He is always seen with his phone, John is always updated with the news and he checks product reviews online before making purchase decision, which is also via his mobile phone.

John is suspicious of greenwashing, he doesn't want to be tricked since the product label as sustainable usually cost higher.

But he doesn't want to ask his friend to investigate everytime, nor he wants to do it himself.

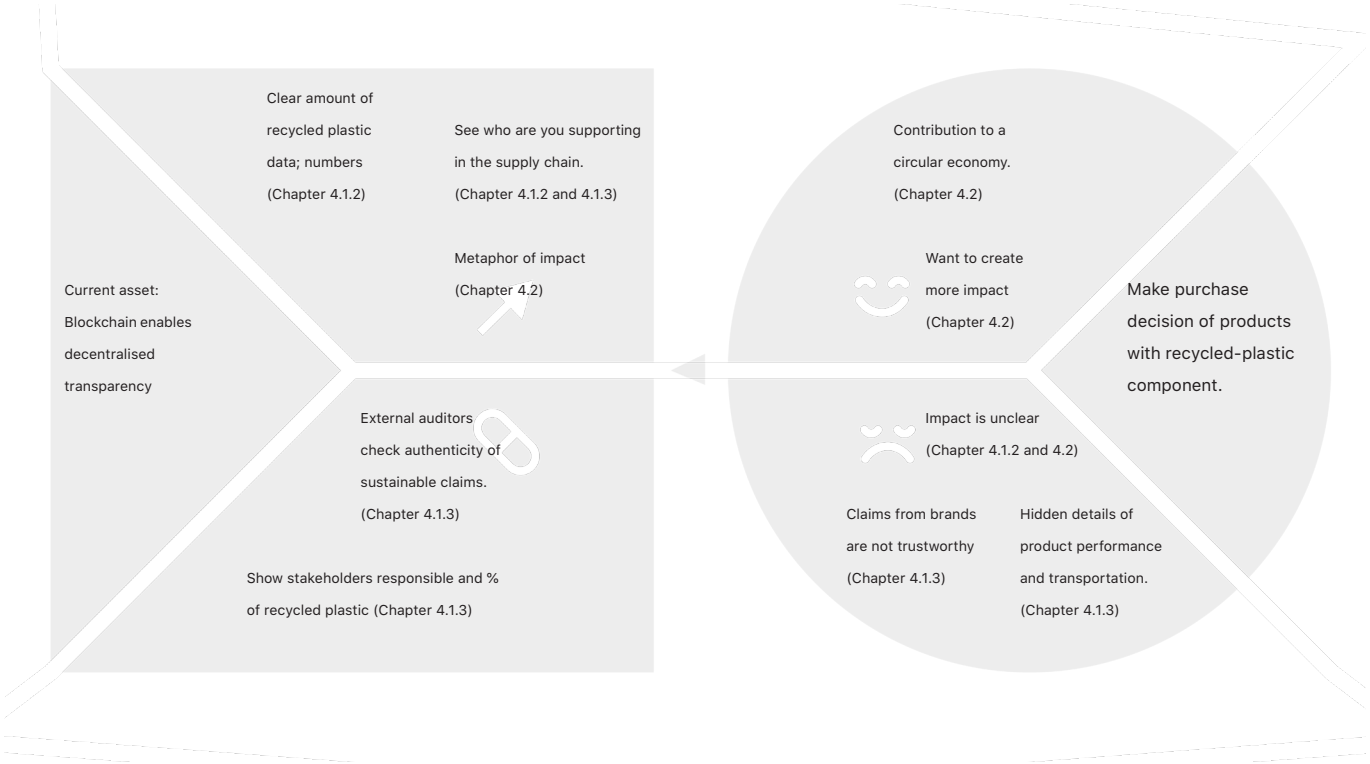
5.2 Value proposition - Customer journey

The customer journey concludes the specific value proposition for each part of the journey of the decision-making process to purchase durable recycled plastic products. It is concluded with the customer's job, gain, pain. The journey is also added with what the users perceive as a possible gain enhancer and pain reliever.

	Initial Consideration	Barriers	Final Consideration	Evaluation	Purchase Decision	Post-Purchase
Customer Job	Search for sustainable claims on product or packaging in stores. Search for sustainable action online to see how they can contribute.		Option comparison The product's function and feature are prioritized over sustainable quality.		The purchase decision is mostly made at the brand's website to get authentic products.	Users share to peers and others face to face
Gain (Motivation)	The importance of sustainability is known and trigger actions			Value of seeing the impact and contribution clearly.	Feel the rewarding of making a good choice	Social motivation The impact feel bigger as a group. The collaborative effort
Gain enhancer (Opportuntiy)	Clear, actionable information Know how to develop	compare impact of a product over another	Measure the impact to Show that it supports sustainability goals Measure with numbers	Want to keep track and measure their sustainable actions		Comparison and sharing results is a friendly competition Compare impact now with before to keep developing
Pain (Barrier)	Lack of information Lack of awareness of choices Negative image of recycled plastic	Suspicious of brand's claims of sustainable products Overwhelmed by complex information	Demotivation Users feel demotivate when they are uncertain about the impact of their action or choices	Material concern for sustainable choices	Budget Barrier	
Pain reliever (Opportuntiy)	Simplification of process Some label or logo to help make faster and simpler choices.	Provide evidence to create trust Transparency is about showing everything, what is known and unknown. Need information about production	Third party verification Guarantee that recycled material are as good as non-recycled ones.	Measure impact and keep track Impact in easy-to-understand format, like metaphors		Consumers as part of system and informed

5.2 Value proposition and Design Criteria

The value proposition arrived from literature and user research in Chapter 4, it concludes the main value proposition emphasized by the target users in their decision-making process to purchase durable recycled plastic products. It is concluded with the customer's job, gain,



Design Criteria

The design criteria were developed from user research insights. The how-tos were generated from each insight.

Measuring impacts in tangible ways

Focus on providing a measurable impact on purchasing recycled plastic products. Metaphor or comparison could be a strategy to make the information more user-friendly and motivate action.

→ Solve: Users perceived sustainable impact as something distant in the future and not measurable which demotivates them. Consumers choose sustainable options when there is high confidence that their behaviour will make a difference (Peattie, 1999).

→ How to measure the impacts of using recycled plastic in a consumer-friendly way?

Emphasize on trust and blockchain

Design that communicates trust to end consumers that they are using a blockchain-related platform. In addition to providing trustworthy claims, there should be no hidden benefits. Avoid being perceived as taking profits from consumer's personal data. Prioritize transparency in the activities, e.g. by communicating, avoid collecting user data.

→ Solve: Consumers are sceptical of claims that come from the brands directly. They check for truth via news or social media. Third-party verification is trusted.

→ How to communicate to users that they are using a trustworthy blockchain platform?

Raise awareness

Raise awareness of the quality of recycled plastic products by informing about expected performance (functional performance, aesthetic, and affordability) and comparing with the performance of a product that's made of new material.

→ Solve: Consumers perceived products made of recycled plastic as higher risk in aesthetics, Functional performance, Effort, and Affordability. Consumers choose sustainable options when compromise is low.

→ How to decrease the perception that recycled plastic has higher risks in performance?

Motivate

Motivates continuous engagement. For example, build user experience as a social platform, or gamification.

→ How to keep the users motivated?

→ How to create a group effort without becoming a social platform?

→ How to keep the users engaged without keeping user's information?

→ How to maintain the habit when the purchase of durable products doesn't happen often?

Enable connection to recyclers

Circularise's future vision goes beyond end consumers. In the future when the recyclers join, the material tokens have to be able to reach recyclers to enable the proper end of life treatment.

→ How to enable communication of the claims to the recyclers after the consumer used the product?

→ How to make sure the user passes the token to the recycler at the end of the product's life?

Scalable

Circularise is continuously growing their network with various clients. While this project focuses on a durable plastic product category, the experience should not restrict only to this category, and be able to apply to a range of industries in the future.

→ How to allow the design to be scalable to other product and client categories?

→ How to design a platform that is not restricted to the product category?

5.3 Circularise Positioning

Since Circularise was mainly targeting business clients like manufacturers, government, OEMs, etc., the current brand identity communicates to those target users. An interview about brand association was conducted to see how the project's target users perceive the existing brand.

Competitor

While there are many non-sustainable blockchain services for social money, gaming currency, and proof of authenticity of products. There are also a lot of sustainable product review websites.

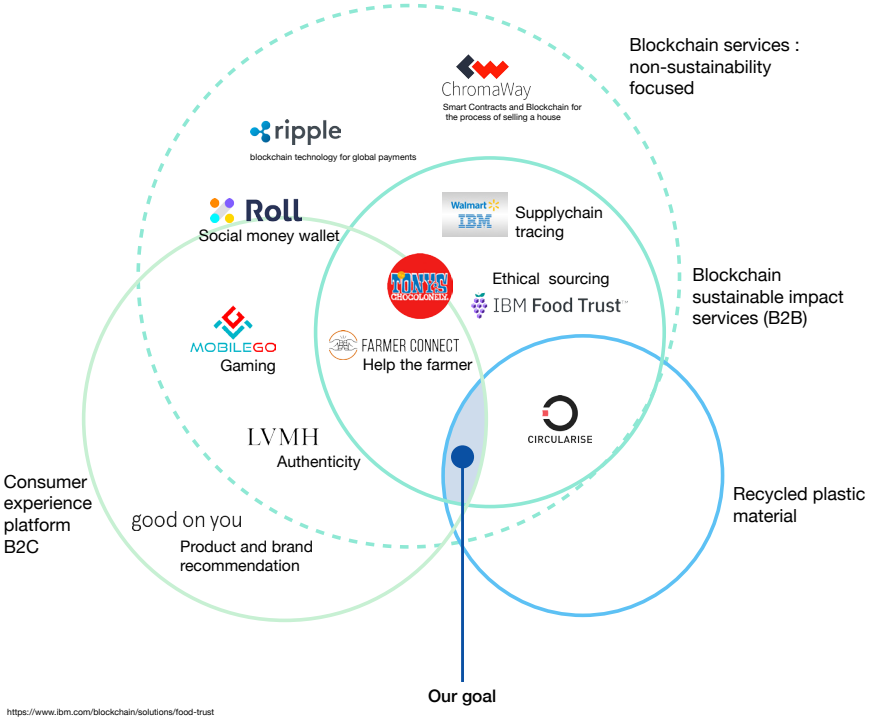
Circularise is currently the only one positioned for the consumer experience platform (B2C), blockchain sustainable impact services (B2B), and focusing on recycled plastic material.

Positioning

Circularise could benefit from the smart-casual sustainable enthusiasts as early adopters since they resonate with the level of sustainable value provided and willingness to adopt Blockchain.

According to the research in Chapter 4.1.3, Circularise should position as a third party. To the end-consumer, Circularise should stay as a third party that doesn't involve in the brands nor gain direct benefit from the purchase. Circularise should position as a trustworthy "peer" who provides and suggests relevant information and tips about the circular economy.

To other stakeholders (brands, OEMs, part manufacturers, and material manufacturer), Circularise open to door to connect their sustainable values and efforts to end-consumers so they can be recognised and supported.



https://www.ibm.com/blockchain/solutions/food-trust

https://www.thankmyfarmer.com/

https://blog.hubspot.com/marketing/blockchain-companies

5.4 Value flow

Circularise and Consumers

Circularise offers the value for consumers to identify themselves as sustainable consumers who has access to prove of sustainable products. This allows them to share new experience and inspire others. Circularise also provides the opportunity for them to measure if their action is align with their goal

The consumer offers trust and in the future, hold the key to sharing of data to the recyclers.

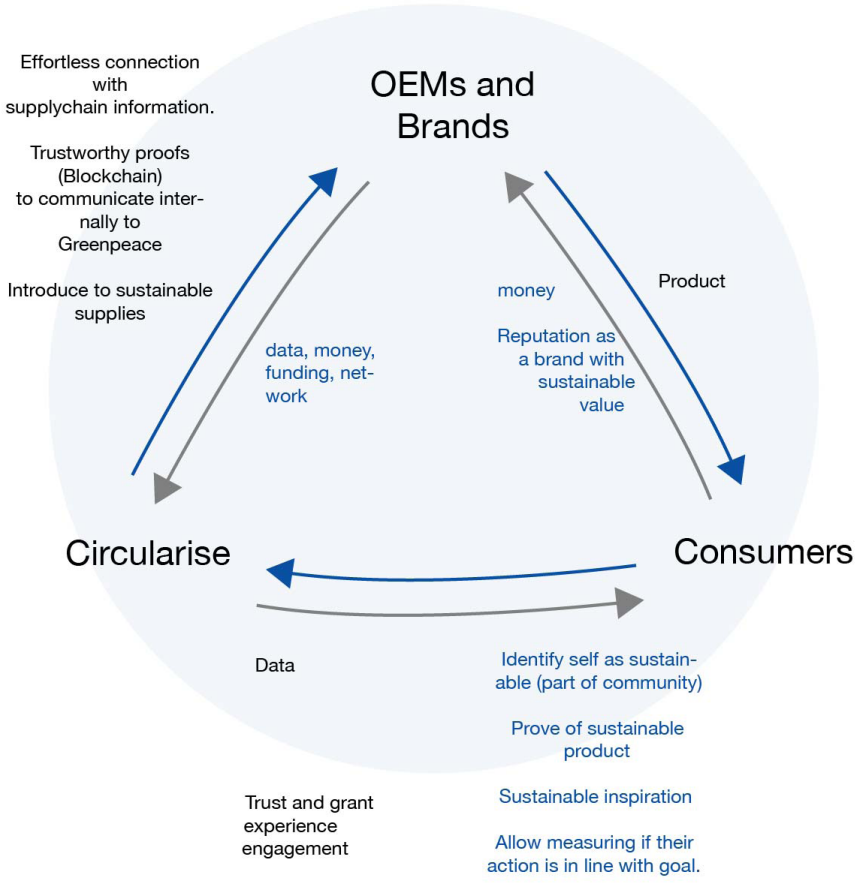
Brand and Consumers

The brand provides sustainable product in exchange to product's cost. The consumer offers the reputation for the brand as trustworthy and sustainable.

Circularise and Brands

Circularise B2B platform has been providing value to the brands by connecting to supplychain information and gaining trustworthy proof of sustainable resource.

In exchange, the brands helps to expand Circularise's portfolio and also introduces to more connection off the supplychains.



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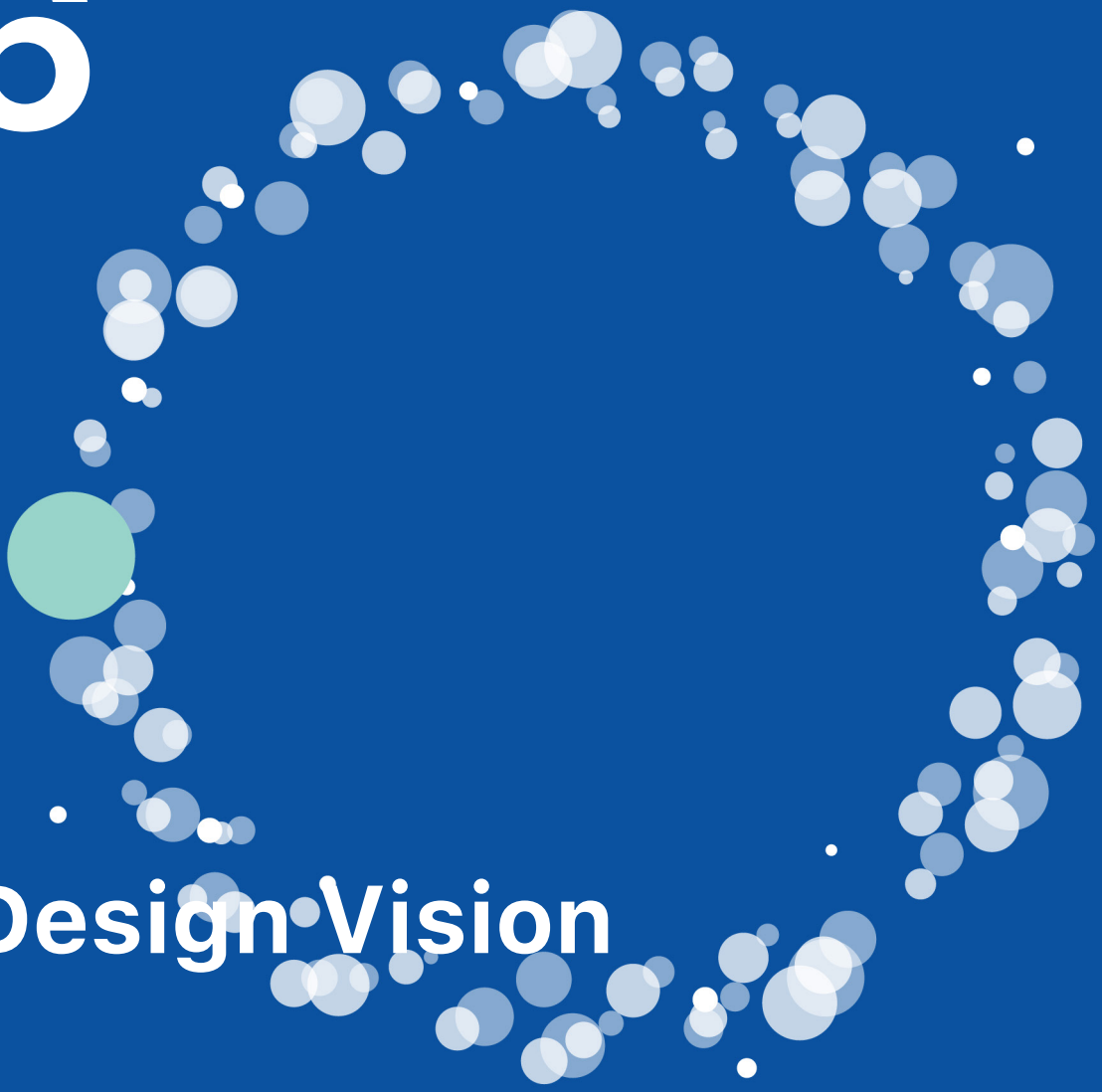
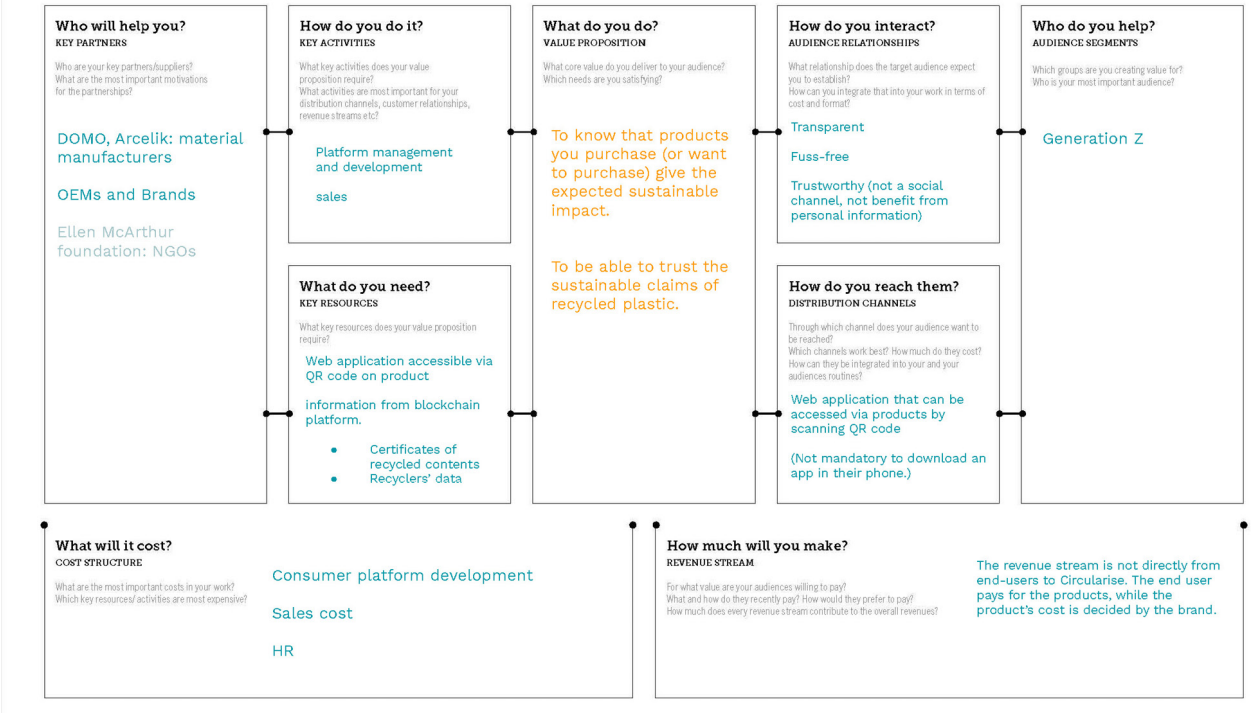


Design Vision

6.1 Business Model



Value Proposition

Circularise offers two main value for end consumers. Firstly, it shows that the product purchased give an expected sustainable impact. It also allow consumers to trust in sustainable products and brands.

Audience Segment

The target users aim at generation Z as early adopters. The detail of target segment was explained in the persona (Chapter 5.1)

Key Partners

The keypartners are Circularise's current B2B clients, namely, DOMO, Arcelik: material manufacturers, OEMs, and brands. There could be involvement of foundations and recycler in the future.

Key activity & Audience relationship

Platform management and development are the main key activity to maintain the audience relationship, which is transparent, fuss-free, and trustworthy (not a social channel, not benefit from personal information). The advertisement of Circularise would come from brands involved.

Key resource and Channel

The key resources were the same with the B2B platform, which is a web application accessible via QR code on product information from blockchain platform, certificates of recycled contents, and recyclers' data.

The Revenue Stream

The revenue stream is not directly from end-users to Circularise, but by the manufacturers who wants to create the material claims. The end user pays for the products, while the product's cost is decided by the brand, which links to the material manufacturer. This new segmentation would support the revenue of the B2B segment.

Cost Structure

The cost structure includes consumer platform development, sales cost, and HR.

6.2 Brand Design

While end consumers are involved with the stakeholders for circular economy group effort, they speak different languages and need different communication styles for most touchpoints. To attract and communicate with end consumers, Circularise should develop another brand design.

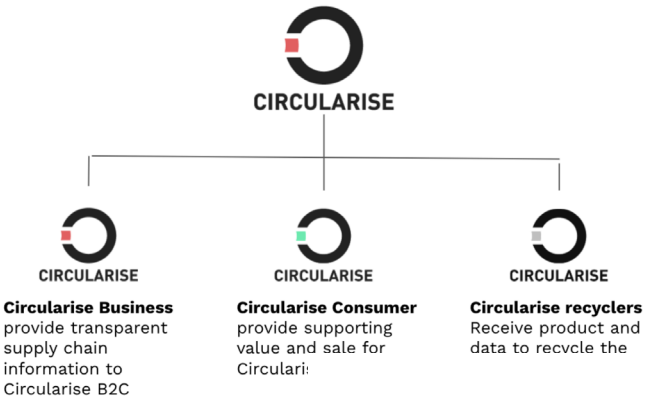
Since the consumer platform needs to be connected with the supplychain (current B2B brand), and the recyclers in the future. The design has to clearly differentiate them from their current B2B segment, but percieved as sharing the same goal with Circularise B2B in circular economy. With the requirement of sharing the same value across all target segments, the brand architecture that's suitable is the structure of a branded house.

6.2.1 A Branded House

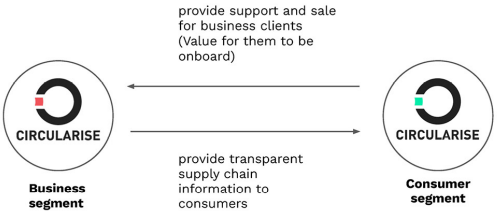
A branded house is a suitable brand architecture for Circularise since the master brand's credibility can be leveraged across different segment of users [81]. It is efficient since the brands are part of one family, which allows saving across numbers of area [81]. In this case, it would be the sharing of data and exchanging value.

The disadvantage of a branded house architecture is that the brandswill be connected and relying on each other. Any effect on the master brand will affect the whole groups of product/service. However, for Circularise, this is not a disadvantage as the brands also share values in many levels.

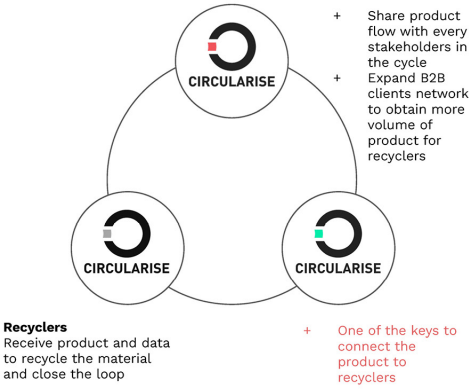
[81] Beverland, M. (2018). Brand management: Co-creating meaningful brands. Sage.



With this brand architecture, the value sharing between business, consumer, and recyclers segment can be visualised as follows.



For the future goal, both the business and the consumer segments aim to connect the recyclers together.

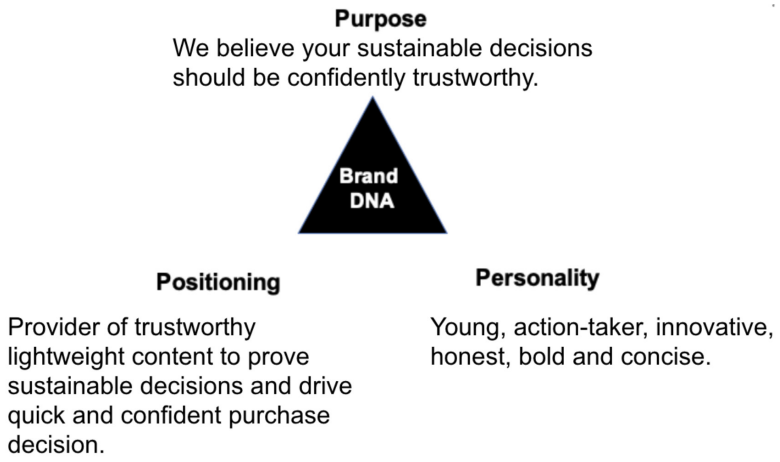


6.2.2 Brand positioning

For (target audience) smart-casual sustainable enthusiasts, (brand) Circularise offers access to (product category 1) product's sustainable impact and trace (product category 2) product's origin that is (product attribute) trustworthy, enable effortless and confident purchase (functional benefit) decision and empower (emotional benefits) people to be an (self-expressive benefits) impactful player of the circular economy.

6.2.3 Brand DNA

Circularise aims to be the perfect bridge of consumers with the rest of the stakeholders in the circular economy via product story and transparent material information, so the consumer can be at ease while making a purchase decision. The purpose is to empower consumers to make sustainable decisions, "we believe your sustainable decisions should be confidently trustworthy". With brand values, Circularise targets smart-casual sustainable enthusiasts as early adopters since they are explorative and strive for the new sustainable experience to create more impact, and willing to spend more for sustainable options. This resonates with the personality of Circularise as young, action-taker, innovative, honest, bold, and concise, no-nonsense. The brand DNA fits Circularise as an icon of consumer's power in supporting the circular economy. It fits Circularise's service offering which addresses trust in sustainable supply chain data. This also influences users' mindset to be part of the action.



6.2.4 Brand Identity

Brand Manifestation

Name and Logo - The goal is to maintain the same logo to maintain recognizability while differentiating the brand for the new user segment.

CIRCULARISE

CIRCULARISE
Consumer

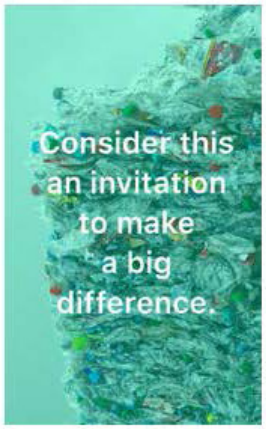
Message Tone

Bold and concise: bite-sized format, easy to understand and goal-oriented, only actionable text and value description

Font: a sans serif type, match the visual clarity of the platform UIs, legible and neutral.

Colour: The mint-green tone represents the balance of sustainability (green) and technology (blue) with a hint of activation.

The tone of voice - Bold call-to-action, speak with the consumer, non-technical narrative. Smooth continuous storytelling



Product's impact, transparently proven.

Blockchain Technology

Circularise keeps track of products' supply chain by using blockchain technology, so you can access each specific product's complex sustainability information of origin, production, and material content.

Simple,
Trustworthy-proven,
Product's story in a few taps.

Product's story, traced back to its origin.

Consider this your invitation to make a big difference.

Everything you need to make sustainable decision.

Picture of sender

Physique
Easy access, portable.

Personality
Bold, Simple, Innovative

Relationship
A storyteller, always reachable and connected. Life-changer

CIRCULARISE

Culture
Straightforward, empower people through technology, Made in NL.

Externalization

Internalization

Reflection
Self enhancement
Connected

Self-Image
Young, sustainable, doing good, smart decision maker.

Picture of receiver

6.2.5
Communication strategy

A three-stage journey communicates according to each user journey phase from chapter 2. These stages vary in action-needed and goals, therefore, different emotion and message tone of voice were created.

Aware & Activate
Recognition phase

Users are aware of what Circularise do with a brand with a clear value proposition and neutral third-party position. They are triggered to take more action to obtain that value and enter Circularise's platform.

Main touchpoint - Brand's website and stores

Message tone of voice - Behold! this product is sustainable, access to see why and how. Let us show you how we prove this as a neutral party.

Impact & Story
Consideration phase

Users are provided with data of recycled content in the product. The data is translated in consumer-friendly language with metaphorical comparisons, % of recycled content, and trustworthy auditor. Users are taken into the product's journey from the origin of material to the final product by showing how each part are produced and who produced them with visuals or micro-documentary.

Main touchpoint - Circularise consumer platform

Message tone of voice - See why this is sustainable! This is the impact you will make. See the product's journey why it's sustainable.

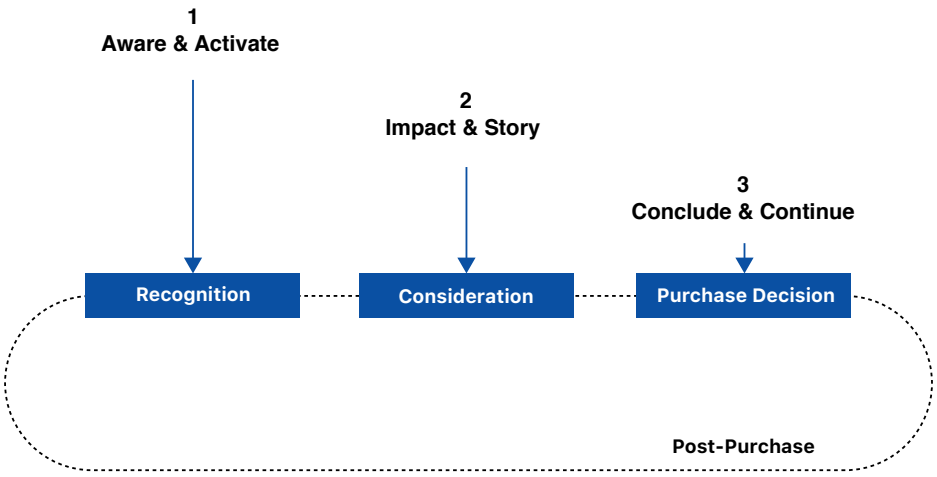
Conclude & Continue
Purchase decision phase

Users feel empowered with all needed information and confidence to make a purchase decision. Consumers perceived this stage as the starting point to continue being part of a circular economy. They play an important role now, and the role will get more impactful in the future (when Circularise includes recyclers in the loop).

Main touchpoint - Circularise consumer platform and Brand's website and stores

Message tone of voice - Choose this sustainable product, be on-board with the circular economy.

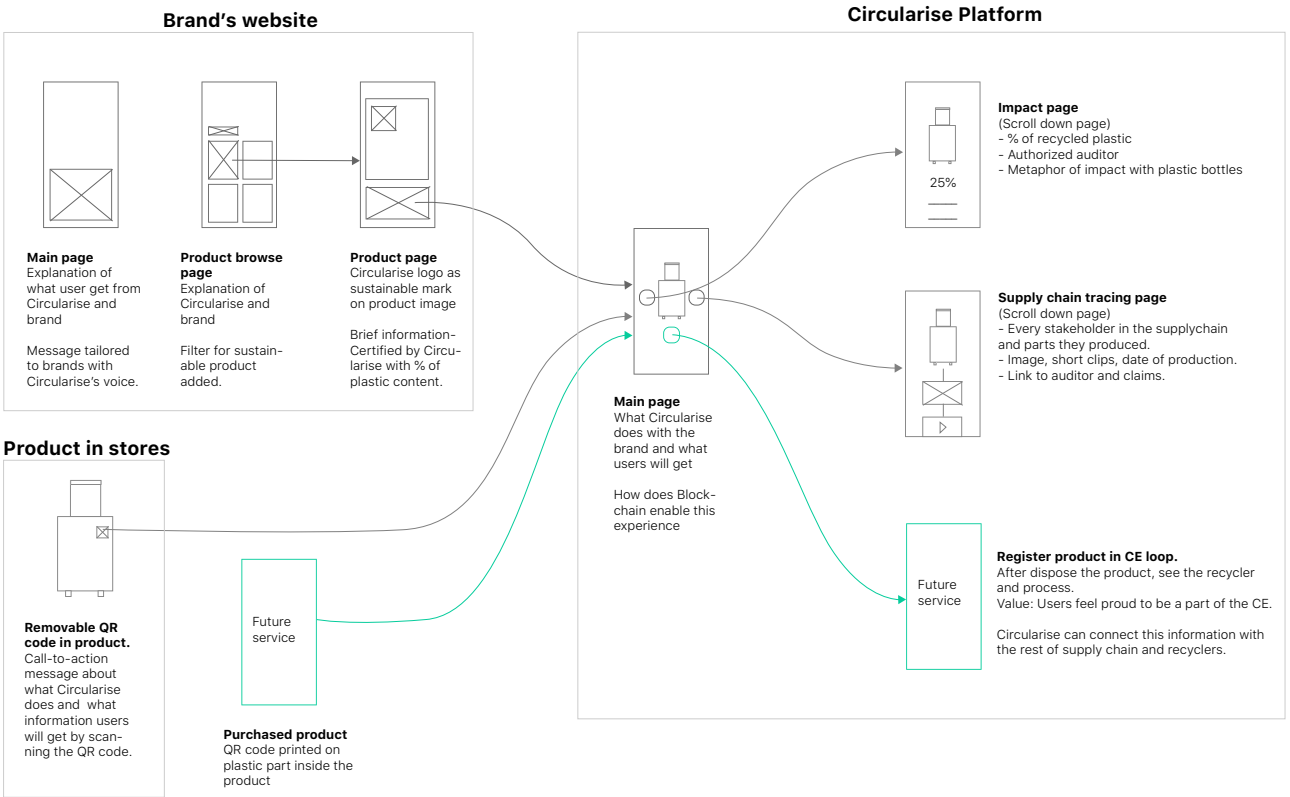
This communication strategy guides the service blueprint and platform design in Chapter 6.2.



6.3 Service Blueprint

After the conceptualisation and brand design, the service blueprint was built. The ideation process was done personally and together with Circularise company. The design was developed in an iterative process by co-creation and testing with three rounds of sprints with five target users individually.

The final service blueprint consisted of two parts, which is a removable QR code that's prominent with clear instruction where it leads to, and another permanent QR code inside the product which is only accessible after purchase for a future vision purpose. The brand website has several touchpoints with the explanation at the main page, and links at product gallery page and product page.



6.3.2 Iterative Process

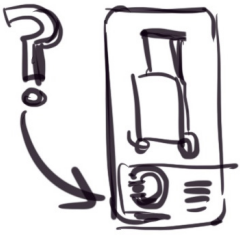
The service blueprint was developed into the first MVP, which then we developed for functional tests, which was a 3-round iterative process with 5 target users individually.

		Key decisions			
Test	**Goal**	**1st iteration**	**2nd iteration**	**3rd iteration**	**Overall Value**
Store touchpoint	Validate concept of call-to-action communication and willingness to	Understandable cue for action Need more indication where the scanning leads to.	Removable QR code on product after purchase and have another option inside the product for after puchase.	Circularise logo should be kept on product as a sustainable indication.	Allow users to access sustainability information as part of purchase decision. Messages from a third party (Circularise) are more trustworthy than message from brands. "Trust is there because there is the number which is strong" "Trust is there because there is showing supply chain" "The information is relevant for me to make purchase decision" "I want to use this, this would help me choose my sustainable product" "I love it when companies are transparent and I can see details if I want."
Online touchpoint	Validate concept, hierarchy of information, and willingness to	Develop communication with more detail what Circularise does.	Balance and prioritize the user's goal which is purchase decision, and less learning about	Provides some key decision making information on brand's website before linking to Circularise's platform. For example,
Circularise Platform main page	Validate concept, communication, flow of platform, communication	Less information about what blockchain is, more about what blockchain allows user to do	Has two choices at the main page for impact and supply chain tracing	Bring some information right away to the main page to drive faster purchase decision.
Product's impact page	Validate communication of impact that influence purchase decision and	The percentage of recycled plastic is clear and create trust. The metaphor to bottles communicates well. "it	The circularity score is not helping unless the score is wellknown The information of product's production lot number is not essential.	Referencing the Sustainable Development Goals emphasize the goal and trust. The scrolling page
Supply chain story page	Validate storytelling content while introducing product's	Develop more detail for each material component, less linking to other pages. To trace backwards, start	Explain in extra which company do which part when there are more than one. Explore providing production time .	Create more engaging story by using manufacturing companies' production image, micro-content

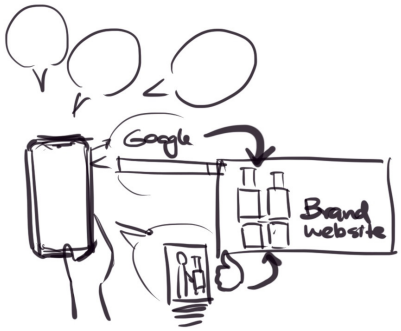
6.4 User Scenario

John wants to get a suitcase for his coming trip. He browses google and some brands he recognised. John looks at 'A' brand website since it's well-known for good products.

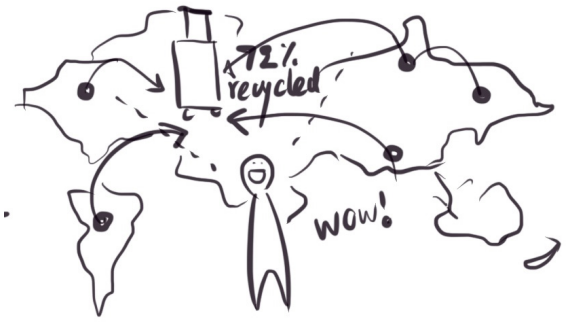
He saw Circularise's logo on a product image, along with the text explaining how it's made with recycled plastic.



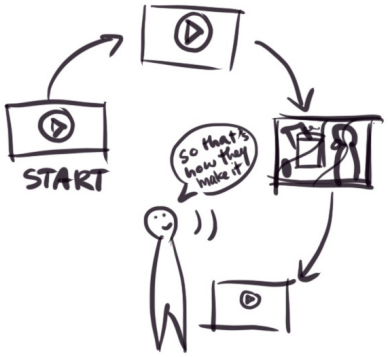
In life, John has been choosing an electric car, train other than flights, and paper packaging. He was unaware of this possible option for a travelling suitcase. Now John also wants to make sure he chooses the most sustainable suitcase possible, just like how he did with everything.



Out of curiosity, he follows the link. Circularise's platform appears with a sentence saying it uses data obtained by blockchain to get this detailed information for him. He immediately sees that he is contributing to a reduction of 72% of virgin plastic usage, and that's the same amount to hundreds of plastic bottles.



He wants to support this, but John wonders if this is true, it did operate by Blockchain, but who is behind it? John sees that he can look at the product's story of how it's produced.



He sees the timeline of product, who, when, and where produced it. There is also a name of an external auditor who verifies this. He can see the short video of how each part is made with a narrative of the person making it. John is 100% sure he is supporting the right sustainable product and the people behind it.

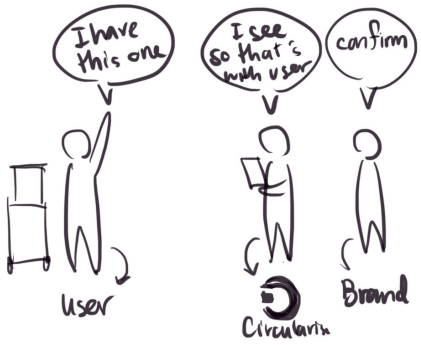
John remembers the value that Circularise provides and look for Circularise's logo on products everytime before purchase. He also introduces it to his friends who also want to contribute to sustainability

6.4 User Scenario

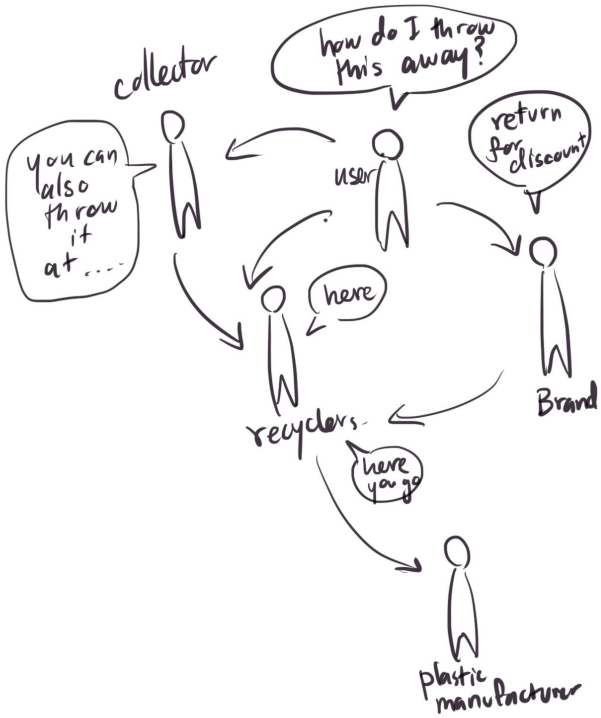
Future Scenario

1. John opens the suitcase he bought and sees a QR code with instruction to scan and register.

2. He is connected in a platform with Circularise, the brand of product, and other stakeholders who're related to the product.



3. When John wants to throw the product away, he can ask to the platform and see the options. This way, John can contribute to keeping the material in the cycle, and be a key player in the circular economy.



6.5 Consumer Touchpoint Design

This section explains general information of Blockchain technology and how it enables supply-chain transparency.

Online touchpoint

The first touchpoint is usually the brand website where users browse for authentic products. Circularise's logo serves as a logo of sustainability and triggers the user to be aware of sustainable choices. The product's sustainable information is given along with the trigger to link to Circularise platform to learn more.

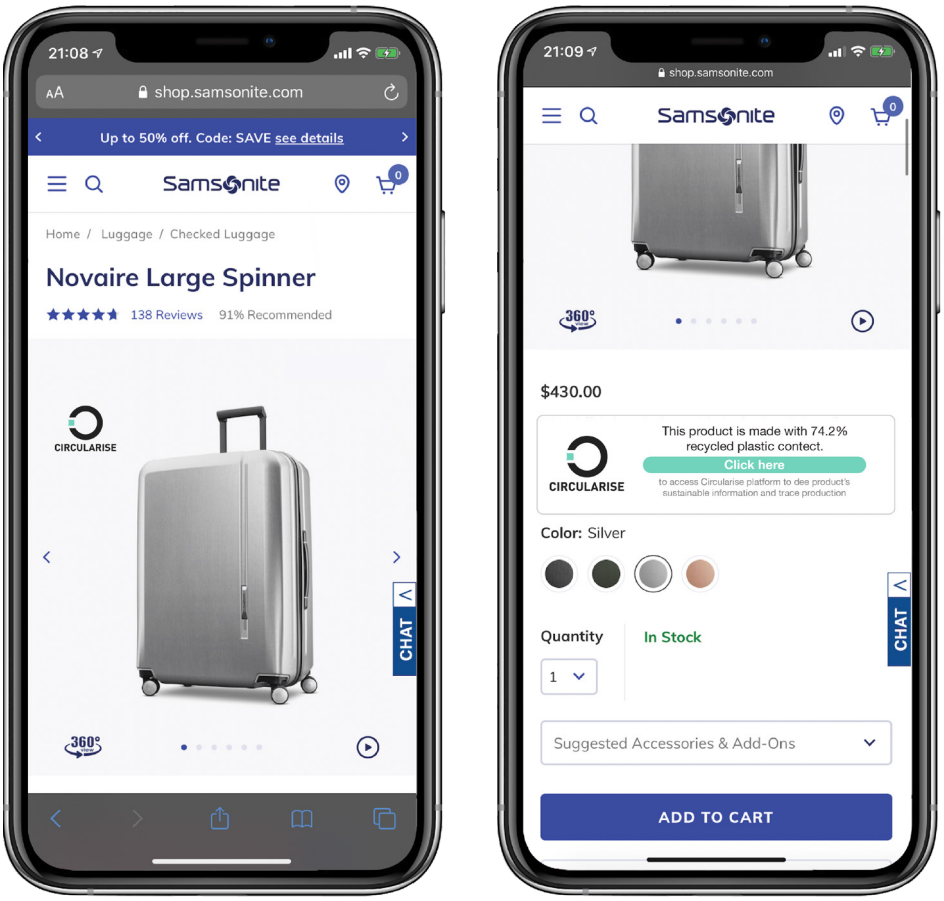


Figure 6.5.1 The visual of online platform touchpoints

Store touchpoint

For users who visit the store, they will see Circularise's logo with a QR code on each product. Next to the QR code has instruction "Scan here to access this product's sustainability information".

After purchased touchpoint, inside the product, users can scan another QR code to register the product in the system. This is for future service of linking the user with other stakeholders. For now, the label instructs the users to keep this QR code until after they dispose of the product because it provides information for recyclers about how to recycle this product.

Figure 6.5.2 The store/ product touchpoint

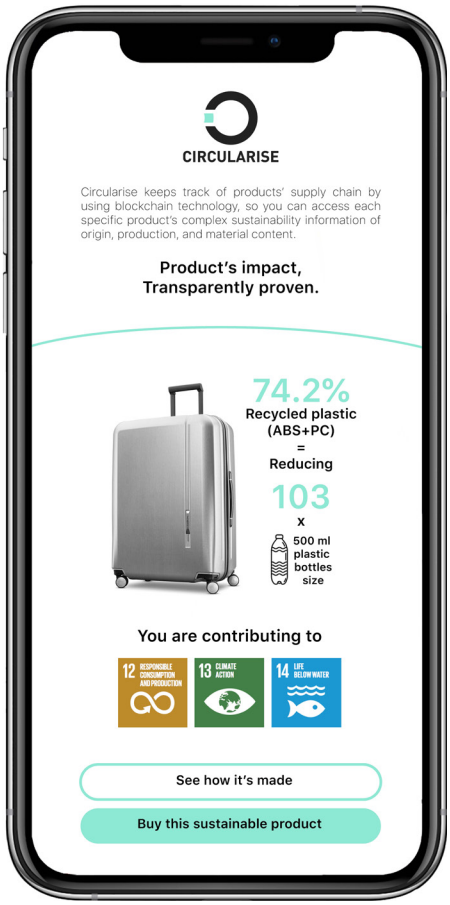
6.6 Platform Design

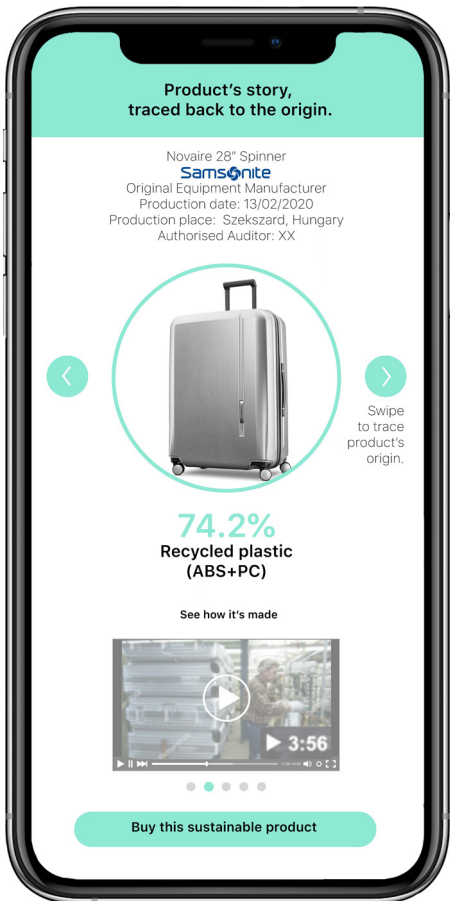
Platform Design

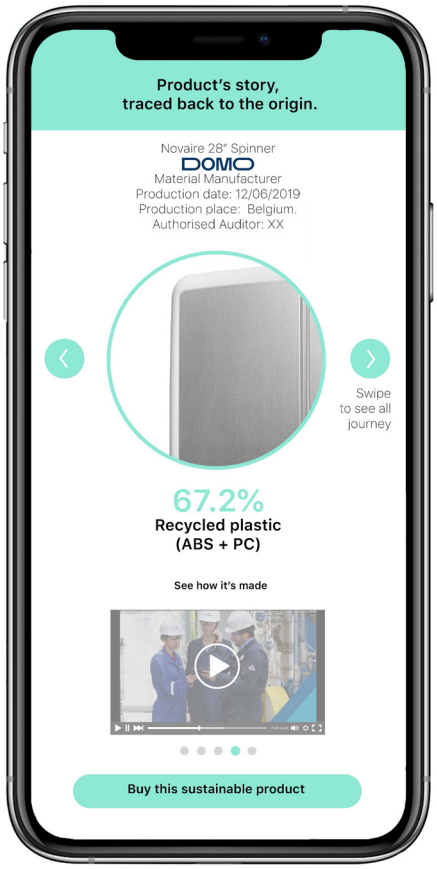
The first page provides basic information about what Circularise enables consumers with the help of Blockchain technology. The sustainable information like amount of recycled plastic and measurable metaphor is given right away on the first page. Users can continue to look at how the product is made, or make a purchase decision. The purchase decision link is in every page and it will link back to the brand's website.

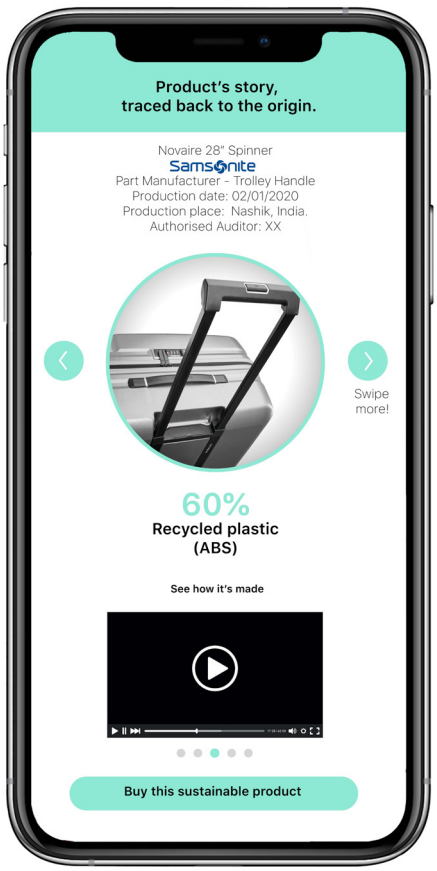
The tracing story page starts with the current product, who produces it, production date and location, and external auditor who verified this. A short video of the production process is shown to get a deeper understanding. Users can continue to swipe to trace back to part manufacture, and material manufacture.

After tracing back to the origin, the user will see a map with all locations how things are made and transported.









After tracing back to the origin, the user will see a map with all locations how things are made and transported.

6.7 Implementation Strategy

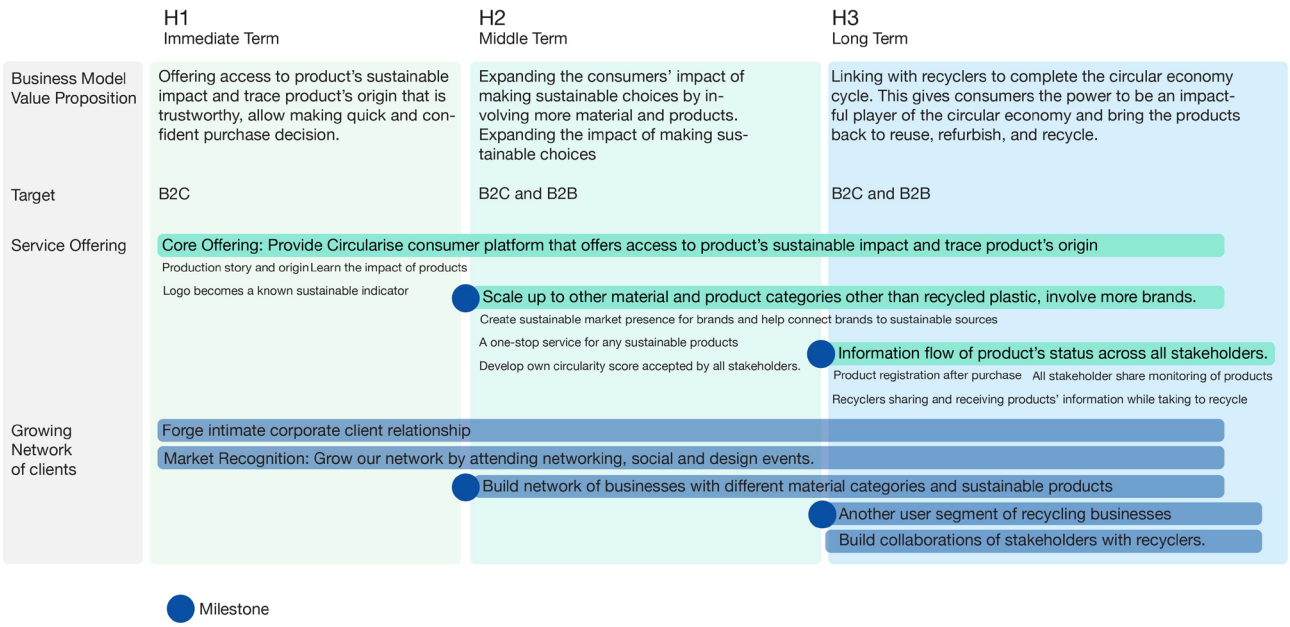


Figure 6.7.1 Implementation strategy visual of the three horizons

Immediate terms (1st year)

The value proposition for the first year would be offering access to a product's sustainable impact and trace the product's origin. The goal is for users to be able to make an effortless and confident purchase decision of products with recycled plastic components. The core offering is the platform that provides the product's story and the origin and allows users to see the product's impact (% of recycled plastic and type of plastic). Users will gradually recognize the brand logo as a sustainable emblem. While offering this service, Circularise will also continue to expand the client portfolio with more brands, manufacturers, in various material industries.

Middle term (2-5 years)

The middle term aims at developing for both B2B and B2C segments. The goal is to expand consumer's impact of making sustainable choices by involving more material and products that Circularise obtain from immediate term connection. This enables Circularise to scale up the service offering to other material and products. While remaining neutral, a large number of brands involved allow Circularise to become a one-stop service to search for sustainable products, the first touchpoint for consumers who are looking for sustainable products instead of only from the brand's website. With this service, Circularise could enable comparison of products, create more online presence, and establish Circularise's circularity score. Users can now collect tokens since there are more products and the amount of purchase involved. The tokens are used to drive motivation and habits.

Long term (5-10 years)

Circularise would be ready to move forward with closing the loop by involving recyclers and develop their connection with the other stakeholders, all manufacturers, brands, and consumers. The value proposition is to link everyone together to trace product further and create opportunities for product take-back system or transfer to recyclers. This collaboration can determine how the product can be recycled or remanufacturer by brands, OEMs, part manufacturers, material manufacturer or reuse by other consumers. The service offering becomes a platform that allows the information flow of the product's status across all stakeholders. Everyone involved can register the status of the product and monitor the product lifecycle. The usage of tokens can be more diverse than before, e.g. donation to support recyclers.

Design recommendation for Immediate term

Cocreate visual language for brands' touchpoint while remaining Circularise's neutral party tone of voice. Circularise could cocreate a touchpoint to search of filter for only Circularise certified products.

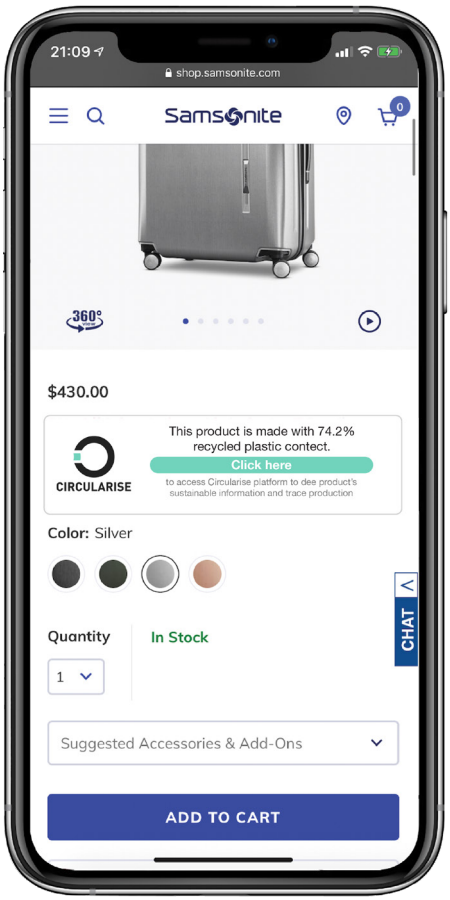


Figure 6.4.2 The design of brand's touchpoint which links to Circularise's platform matches the frame design of the brand.

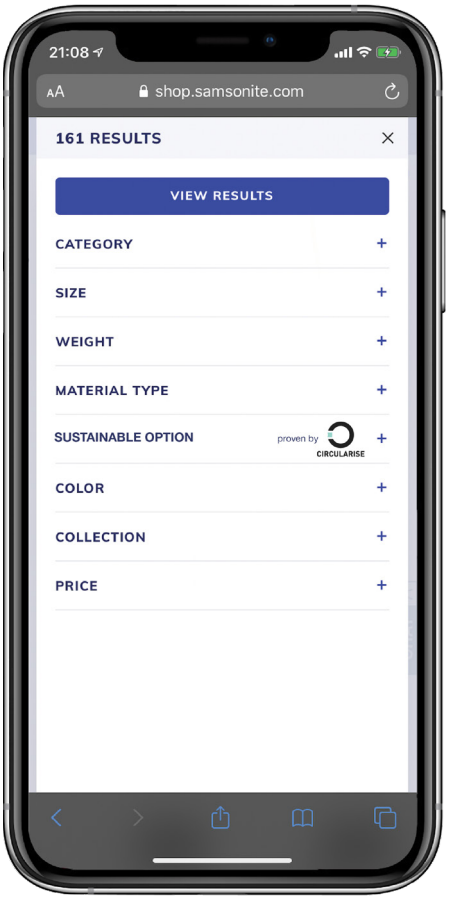


Figure 6.4.3 Visual recommendation of the filter for Circularise's products

Design Recommendation for middle term

Design recommendation: Create product's portfolio and product search to showcase the amount of brands and products involved and establish as a one-stop destination for sustainable choices.

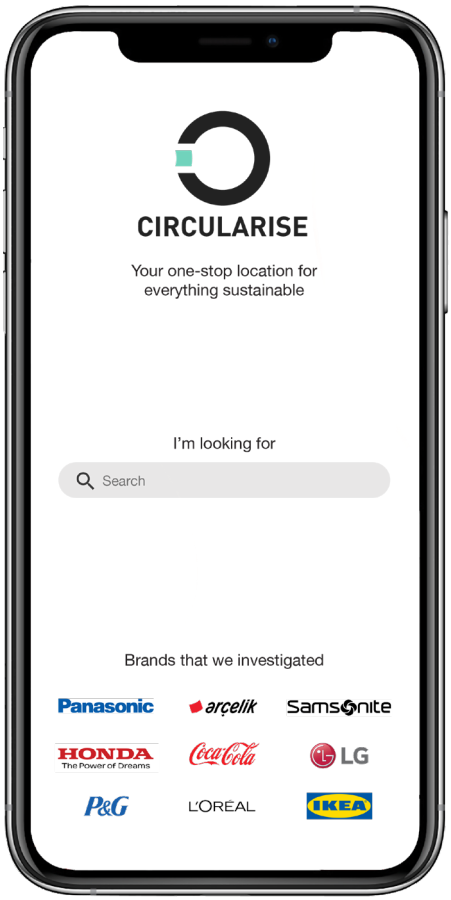


Figure 6.4.4 Design recommendation for product search.

Recommendation for other categories:

WTP for products made of recycled parts differed depending on the product category [20]. Responses to products are likely to vary depending on the product category. As this project focuses on recycled plastic material with durable long-lasting products (suitcases), we propose essential factors to consider to adapt to other categories

- For products that are bought frequently, users are more concern about the total amount of waste generated. (The total amount of waste generated is associate with the frequency of purchase of FMCG compared to durables that they bought sparingly [20].)
- If the product is used publicly, emphasize on expressing the user's image of sustainability to others. (Therefore, some individuals may prefer to use more sustainable products when they are consumed in public and therefore contribute to the personal image they wish to have [26].)
- For products related to food and drinks, provides information related to contamination test results. (consumers perceive circular products made with the recycled components with contamination, especially when associated with food [27]).
- For the electronic appliance, consumers would want to know their energy consumption as part of the impact. (Users often perceived sustainability of durable products by focusing on their energy consumption [25])

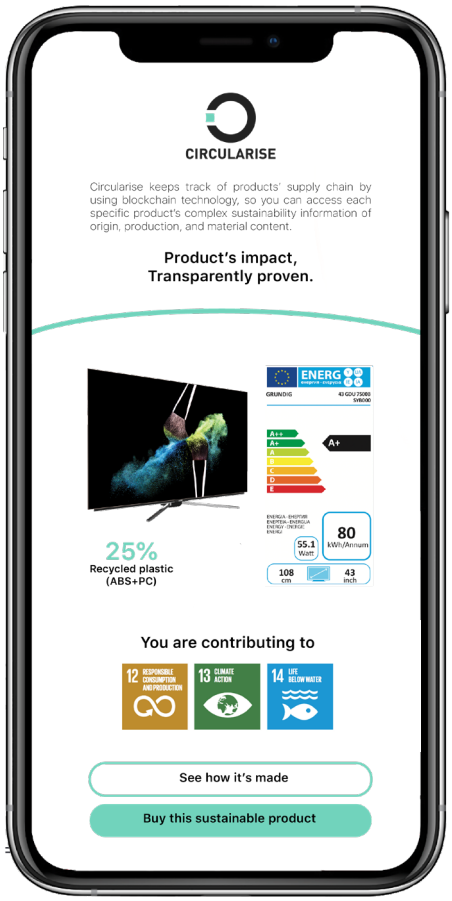


Figure 6.4.5 Design recommendation for electronic impact.

Tokens could be used to support self-improvement and reflect self impact, not as a gain for discounts or marketing tools. This is because it will create inequality to gain sustainable information, and lead to distrust.

Circularity score - how to show sustainable products as not negative, but good, better, and best.

Design Recommendation for Long term

For long term implementation, Circularise would be ready to move forward with closing the loop by involving recyclers and connect with all manufacturers, brands, and consumers.

The design recommendation is the consumer would have to register the product into the system after purchasing it by using the QR code inside the product.

Figure 6.4.6 Design recommendation for the product's touchpoint to connect consumers and recyclers with the supply chain.

With the registration, we create the platform that consumers can monitor the status of their product after disposal and check whether it's recreated into a new part. This could be supported by a product return system. The part manufacturer would also be able to see if the product is purchased.

At this long term implementation, the consumer and all stakeholders's identity would be kept anonymous by blockchain technology.

The usage of tokens can be more diverse than before, e.g. donation to support recyclers.

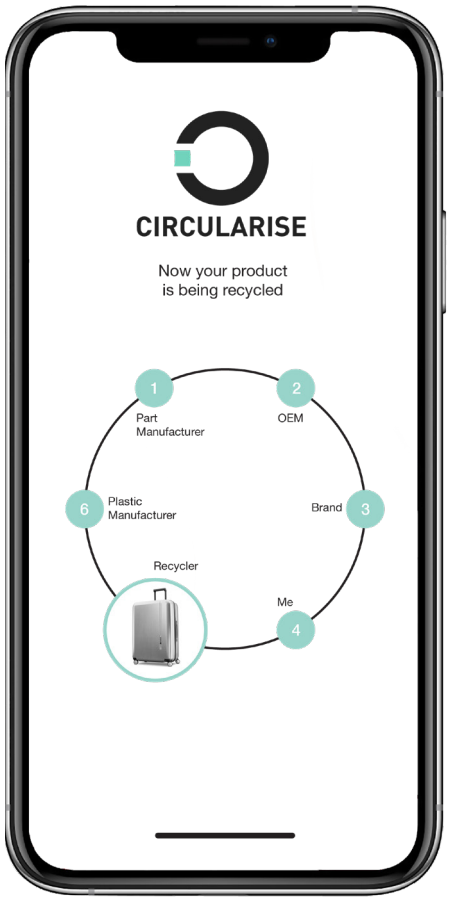


Figure 6.4.7 (right) the platform showing the status that now the suitcase is being recycled.

7

Validation

7 Validation

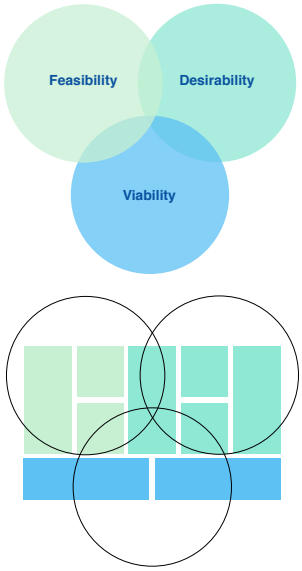
"Your #1 job as an innovator, entrepreneur, or corporation is to test your business ideas to reduce the risk of failure." Alex Osterwalder.

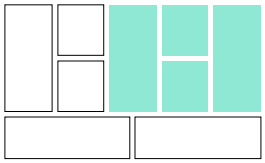
Viability, feasibility, and desirability are considered to validate the design and future vision.

The viability and feasibility validation were supported with interviews with Circularise, whose expertise is with blockchain, sustainability, and B2B stakeholder management. The desirability validation was obtained from target users interviews during the final design iteration.

Goal: Feedback and Validation of concept - Present design and gather feedback

The three validations are connected to the business model canvas as follows.





1. Desirability

Customer Profile

The design adresses, jobs, pains, and gains that really matter to the customers.

"I want to use this, this would help me choose my sustainable product. I love it when companies are transparent and I can quickly see details if I want."

"The information is relevant for me to make a purchase decision. I feel that I can trust and see the information I need"

Value Map

The design relieves customer pains and support the gains.

"Tracing product's origin is fun because it's a story "

"Trust is there because there is a number which is strong. Trust is there because there is showing supply chain"

"I would use this. The product story has a lot of potentials, I would like to know where products are from, it's a story "

Customer Segments

The design targets the right customer segments. According to Nielson's demographic reports, Generation Z-ers have spent more than $143 billion annually, which is significantly higher than other generations at the same stage of life [63].

Value Propositions

The design offer the right value propositions for the customer segment. Our value proposition is also unique enough to considering the competitor analysis and positioning shown in Chapter 5

Channels

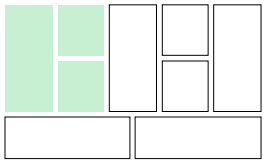
According to the target users, using mobile phone application resonates with them as it's accessible at all times, so they are the right channels to reach and acquire our customers.

"I want to know how I can contribute to sustainable worlds, can be via phone, because I want it to be accessible at all times."

Customer Relationships

With accumulative benefit across the horizons, we continuously empower consumers in making sustainable product choices, motivates them along, and also build customer loyalty by being trustworthy and transparent.

"I would feel more motivated to do because alone it might still be really small but then with a group, it's a bigger impact and you see your influence."



2. Feasibility

From the ideation process with Citcularise, we mapped the ideas on the axis of importance for consumers and feasibility for Circularise. The final validation was done after the final design.

Circularise can perform all activities (at scale) and at the right quality level that is required to build the business model.

"The platform design will need to be defined with a number of UI iteration, and then it can be launched"

"Putting the QR code of the product to see the information about the product, is not new and doable"

The long-termed strategy is perceived as far but the value is perceived as benecial in a long run.

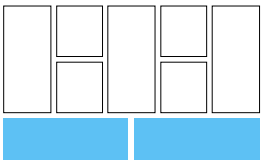
"The long term is far and we don't see it happening soon."

"We want to see the conceptual recommendation of how this will work in the middle term and long term so we can develop it further."

We believe that we can create the partnerships required to build our business.

"we know 99% sure that the brand wants to also communicate."

"Once we do have enough critical mass in a specific area, uh, we are already talking with like collectors and the recycling company."



3. Viability

For the Revenue Streams, Cost Structure, and Profit.

Supplychain and the brands would benefit from this. This B2C service supports the revenue of Circularise B2B, and therefore proven viable since the supply chain stakeholders are the ones sponsoring for the cost of this service. With consumer's involvement, we can attract more brands which make this profitable for Circularis

"It's extremely viable, it's something we are already doing in the sense, and others as well"

"we know 99% sure that the brand wants to also communicate."

"The business model canvas, I don't see anything that would not make sense, it's clear and self-explanatory, and extremely viable for Circularise now"

"nice experience around your customers. And that's where we kind of have to develop a new business model"

Conclusion

This project aimed to explore how design can empower end-consumers by using the value from the supply chain, which is connected by Blockchain, and achieve a circular economy value collaboratively.

To address this challenge, the literature review was drawn upon consumer behaviour of making a purchase decision of sustainable products, and their perception of sustainability claims of recycled plastic products. The research also has drawn upon the value that blockchain technology and the transparent connection of supply chain can enable. The user research extracted a deeper reasoning behinds the behaviour, as well as learned the customer journey (customer job), pain, and gain. The pain that the project addressed was trust in sustainability claim, lack of awareness, and complexity in making a decision with overwhelming information. The insight of the users' dreams (pain reliever and gain enhancer) was also gathered by using contextmapping process. Blockchain technology holds the key to enable pain relievers, which is related to providing trustworthy supply chain data. However, the challenge was the consumers were still unclear of the information they need, and the data of the supply chain was perceived as overwhelming and technical. Therefore, the project took a collaborative approach to develop ideas and solutions together with target consumers and test the MVP in the iterative process together. The ideation with Circularise also defined the feasibility and the potential to develop some less-feasible options for the future. The explored solutions cover across in the product/service level, business model level, and ecosystem level, which is a strategy that leads to achieving a circular economy collaboration.

The platform empowers the consumer to access transparent, trustworthy information that is provided by the supply chain and translated into user friendly, concise communication. The supply chain's sustainability effort is communicated to the consumers and differentiate them from greenwashing businesses. This way, we strengthened the connection of consumers and brands, and all stakeholders who produced the product.

In the business model level, the design enables accumulative benefits of enlarging the portfolio of supply chain and consumers, which allows future development of becoming a sustainability standard. With the collection of more products, Circularise could become a one-stop destination to search for any sustainable products since it's perceived as established and approved trustworthy by the mass.

As Circularise has connected the consumers with the supply chain, and covers many products, connecting with the recyclers would be the most valuable step. With a large number of plastic products, the recyclers would be interested in joining hands. Without the involvement of the consumer, this flow of product would be very challenging to achieve. Therefore, the accumulative benefits from the first and second horizons support this.

The design envisions how Circularise can empower end consumer to make sustainable products choices. Circularise becomes the key to support the ecosystem of consumers, supply chain stakeholders, and recyclers in a collaborative effort towards the same ultimate goal, a circular economy.

Reflection

Reflecting on the design brief, my ambitions of the project were bridging my past and present passion in brand experience and circular economy, developing all my strategic design knowledge and accepting a new challenge. These were aimed to build me towards an in-house strategic designer in the circular economy field in the future.

This project allowed me to connect my passion in a circular economy and brand design. A circular economy benefits the end-user experience, and brand experiences are sustainable without tricking the consumers into a marketing strategy. While exploring with new elements, namely, trust and blockchain data, the project introduces a perfect match that bridge my passion for sustainability and brand experience as a strategic designer, and also stepped into a new boundary of values of blockchain technology.

Regarding my second ambition to deepen my understanding of B2B and B2C businesses, working on this project brought me to the knowledge of a complex value network of several stakeholders of the supply chain and users. The original plan was also to put the skills and tools that I learned from several courses into more practice, such as, Design for Consultancy Practice, Creative Facilitation, and Context mapping. Unfortunately, since the start of this year, 2020, the coronavirus started spreading, and social distancing becomes a new normal for everyone. All research and processes were conducted online, which was an unprepared challenge. However, the virus also opened up an opportunity for me to explore the means of facilitating and user research with context mapping via online methods. While everyone was in social distancing at home, we as humans were even more connected, and we reunited to help each other get through the situation. Therefore, this project received significant interest from the users and professionals, which led to exchanging several incredible ideas. Although the opportunity of learning more from inside Circularise's office had reduced, I've learned a lot about blockchain technology that I didn't at the start of the project. I was also exposed to many new online tools in collaboration and design, which was very challenging as first since I've always preferred more hands-on approaches.

This graduation project has been a long adventurous journey that put my limitations to test, and also one of my proudest breakthroughs. I see this as my most significant contribution to the circular economy field so far, and only a start. I'm looking forward to making more strategic impact in the future.

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Appendix II
User experience research questionnaire

Survey: Sustainability and Trust

Thank you in advance for participating in this survey. This is a quick survey to understand your perception of sustainability and trust (supply chain transparency). It will take around 5-10 minutes to complete, and your information will not be shared and the result will only be used academically.
*Required

1. Age *

   Mark only one oval.

   - ◯ Under 15 years old
   - ◯ 15-25 years old
   - ◯ 26-35 years old
   - ◯ More than 35 years old

2. I believe that sustainability (Circular economy) is important and urgent. *

   Mark only one oval.

   - ◯ Strongly agree
   - ◯ Somewhat agree
   - ◯ Neither agree nor disagree
   - ◯ Somewhat disagree
   - ◯ Strongly disagree

3. I want to know the sustainability impact of the products I use. *

   Mark only one oval.

   - ◯ Strongly agree
   - ◯ Somewhat agree
   - ◯ Neither agree nor disagree
   - ◯ Somewhat disagree
   - ◯ Strongly disagree

4. I trust sustainability claims that come from brands and purchase their products. (global brands that don't have sustainability as their core.) *

   Mark only one oval.

   - ◯ Strongly agree
   - ◯ Somewhat agree
   - ◯ Neither agree nor disagree
   - ◯ Somewhat disagree
   - ◯ Strongly disagree

Appendix II
User experience research questionnaire

5. I trust the sustainability claim of a brand's product that comes from a third party. *

   Mark only one oval.

   - ◯ Strongly agree
   - ◯ Somewhat agree
   - ◯ Neither agree nor disagree
   - ◯ Somewhat disagree
   - ◯ Strongly disagree

6. Why do you trust this third party? if not, who do you trust? *

   _____

   _____

   _____

   _____

   _____

7. Transparency in the supply chain would help to prove sustainability claims (knowing the material composition of recycled plastic, track who produces each part, etc.). Which information in the supply chain do you want to know the most? *

   _____

A fact to answer the following question: According to research, blockchain can enable more transparent and accurate end-to-end tracking in the supply chain. Organizations can digitize physical assets and create a decentralized immutable record of all transactions, making it possible to track assets from production to delivery or use by end-user.

8. I prefer to... *

   Tick all that apply.

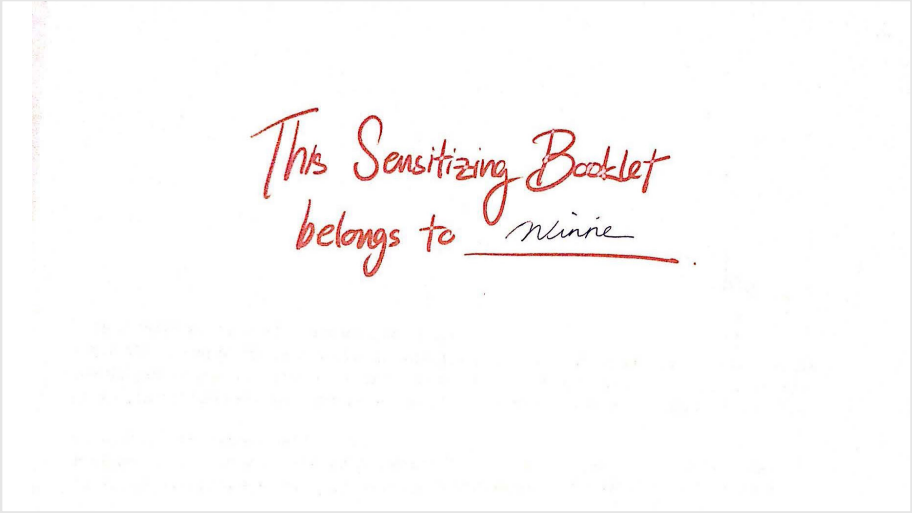
   - ☐ use a blockchain platform and learn how blockchain works to get the supply chain information
   - ☐ find some supply chain information that were proven as transparent by blockchain, but not using blockchain (eg. as tokens)
   - ☐ See a label on a product that it's proven and traced by blockchain (a third party company)
   - Other: ☐ _____

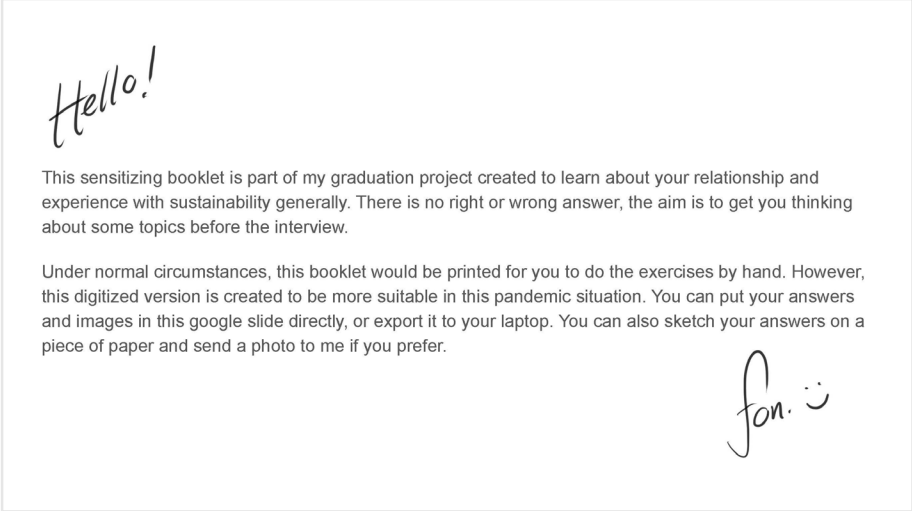
9. What are your current tools/ services that help you to be more sustainable? *

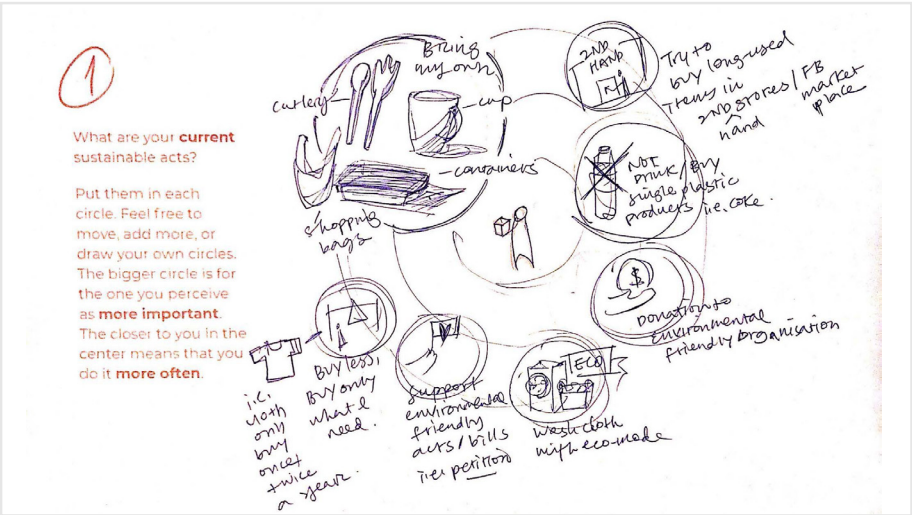
   _____

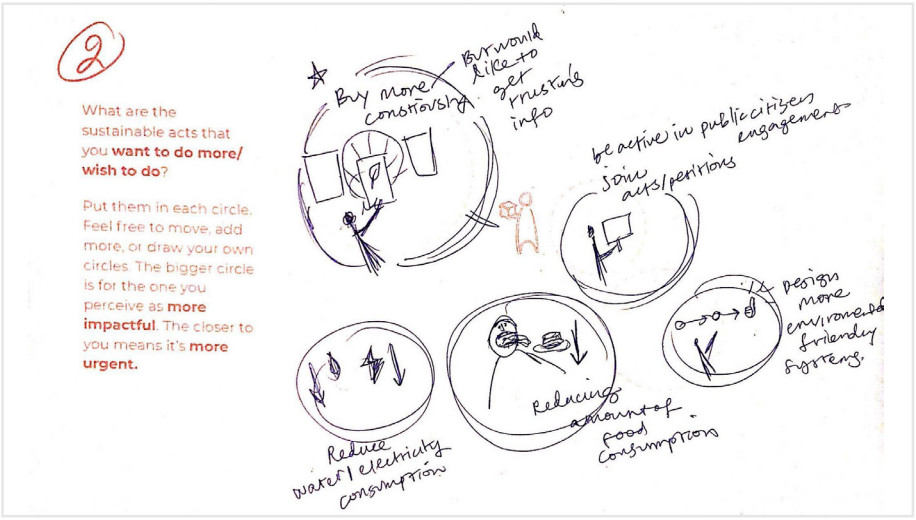
Appendix III
Sensitising Booklet

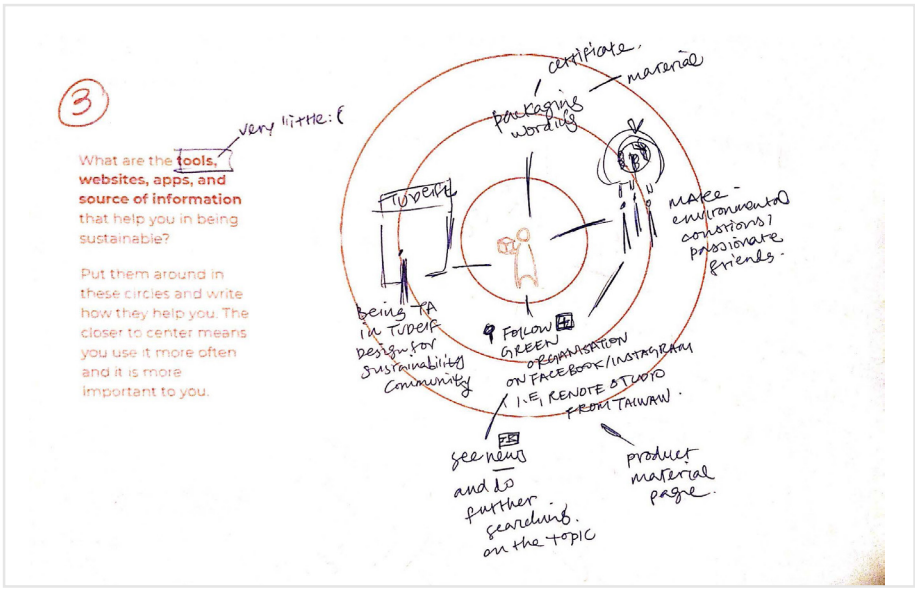
An exmaple of a filled booklet

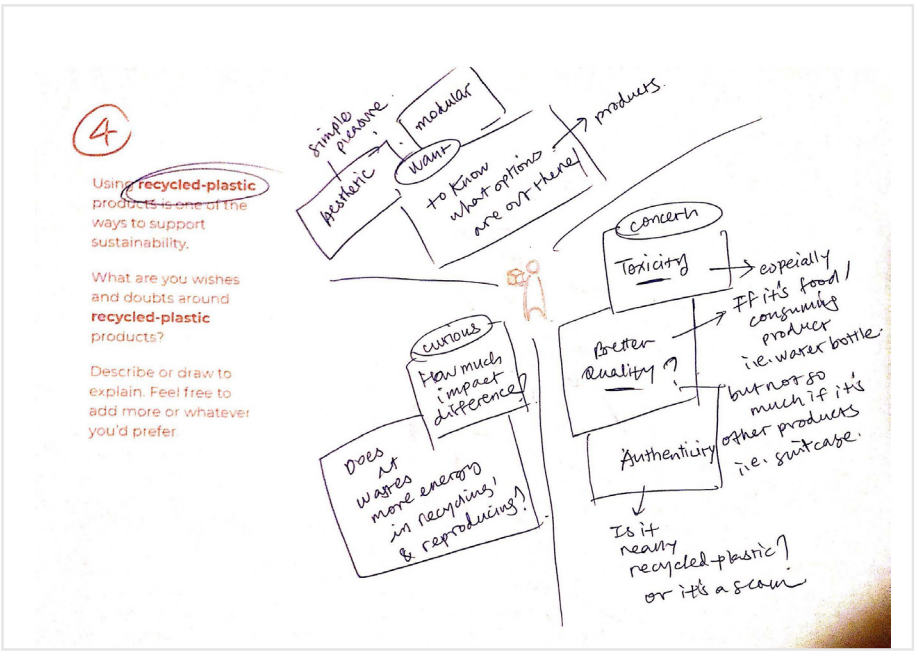







2
What are the sustainable acts that you want to do more/ wish to do?
Put them in each circle. Feel free to move, add more, or draw your own circles. The bigger circle is for the one you perceive as more impactful. The closer to you means it's more urgent.
Buy more consciously
Buy would like to get trusted info
be active in public citizen engagement
Join acts/petitions
design more environment friendly systems.
Reducing amount of food consumption
Reduce water/electricity consumption


3
What are the tools, websites, apps, and source of information that help you in being sustainable?
Put them around in these circles and write how they help you. The closer to center means you use it more often and it is more important to you.
very little: (
certificate
material
packaging
wording
TUDELFT
make environmental conscious/ passionate friends.
being TA in TUDELFT design for Sustainability Community
FOLLOW GREEN ORGANISATION ON FACEBOOK/INSTAGRAM
i.e. RENDE STUDIO FROM TAIWAN
see news and do further searching on the TOPIC
product material page


4
Using recycled-plastic products is one of the ways to support sustainability.
What are you wishes and doubts around recycled-plastic products?
Describe or draw to explain. Feel free to add more or whatever you'd prefer.
simple pleasure
modular
aesthetic
want
to know what options are out there
products
concern
Toxicity
especially if it's food/ consuming product i.e. water bottle
Better Quality?
but not so much if it's other products i.e. suitcase
Authenticity
Is it really recycled-plastic? or it's a scam
curious
How much impact difference?
Does it wastes more energy in recycling/ & reproducing?

Appendix IV
Interview Guide

The interview guide was used while interviewing together with the filled-out sensitising booklet. The follow-up questions are listed in bullet points.

Sustainability perception

What is your feeling toward sustainability? (Question to identify target group)

- Are you familiar with the circular economy?
- Do you think it's important?
- Do you think it's urgent?

What or who influences you to be sustainable? why?

(discuss booklet page 1)

How do you support sustainability currently? (Question for insights and to identify target

group)

- What is the process?
- How does doing this feel?
- Is there any rewarding value?

(discuss booklet page 2)

Is there any barrier that kept you from supporting sustainability?

(discuss booklet page 3)

Are there any tools/ methods/ sources of information that help you to be sustainable?

How do you keep track of your sustainable activities?

- How do you measure if you're doing well? What would help you know?
- Would you like to have something that helps you keep track?

Why does measuring impact matter? Comparison with others? For yourself? (motivation) (do

together as a group effort)

How do you advocate (promote/present) your sustainability to others?

- Do you? In what way?
- Which channels?

Durable Recycled Plastic products

What do you think about recycled plastic products and their sustainability impact?

Do you own any plastic product that contributes to sustainability? (Ask the user to pick a product that they own and use, no FMCG) (Should have a booklet for this part)

- Why do you think this product is sustainable?
- Any product made from recycled plastic?

Do you have a travel suitcase?

What did you consider when choosing or purchasing it?

- Do you consider the recyclability?
- How do you know that this is recyclable?
- Did you consider the material when you purchase?
- Did you consider the production of this product?

How did you find/ know about the product?

- Where did you purchase your suitcase?
- do you search online?
- do you compare with other brands or products?
- do you go to the store and get advice from the sales?

How often do you use it?

What are the reasons to replace the product? (outdated? broken?)

- How long does the product last?

How do you maintain it?

- How do you fix it when broken? (How do you learn how to fix it, what source of information?)
- If it's broken, how do you plan to dispose of the product?

Appendix IV
Interview Guide (continue)

Do you consider sustainability in the disposal?

(Discuss booklet page 4)

About trust with recycled plastic

What information would help you know that the product is sustainable?

Can you give an example of a sustainable business/brand/campaign currently?

Non-sustainable but claim that they are?

Do you trust the companies that claim they are sustainable?

- Why and why not?
- What would make you trust them?
- Would third party help? A neutral party/ expertise.

What information can prove?are sustainable?

- Why and why not?

What would make you trust them?

- Would third party help? A neutral party/ expertise.
- What information can prove?


Consider this an
invitation to make a
big difference.